A Conceptual and Operational Understanding of Social Resilience in a Primary Resource Industry

– Insights for optimizing social and environmental outcomes in the management of Queensland's commercial fishing industry

Thesis submitted by

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THESIS ABSTRACT

Resource-protection policies are frequently implemented without prior knowledge of the likely social and economic outcomes. The consequences of these management strategies can, however, severely erode the ability of resource-users to cope and prosper. The conflict, political turmoil and lack of compliance that are often associated with changes in resource policies can seriously undermine their conservation goals. Design and implementation of policies that are capable of achieving both conservation goals and social and economic sustainability require a better understanding of how resource-users respond to policy change and adapt.

Resilience theory provides a useful framework to examine the ability of resource-users to cope and adapt to changes in resource policy. Holling introduced the concept of resilience to the sustainability sciences in 1973 as a means to better understand how ecological systems can persist in the face of change. This has provided the foundation for a shift towards the resilience-based management of natural resources and the social systems that depend on them. Despite theoretical advances, however, our conceptual and practical knowledge of the social dimensions of socio-ecological systems remains limited. In this study, I aim to improve our understanding of several aspects of social resilience using the commercial fishing industry in North Queensland as a case study.

A conceptual model of social resilience to policy change is developed in the first part of the thesis as a precursor to an operational model. In developing the model, the level of dependency on the resource and a fisher's perception of policy change were identified as potentially important influences on social resilience. The model depicts the key characteristics of, and the linkages that are likely to exist between, social resilience, resource dependency and policy perception. The model was developed using a novel combination of resilience and social science theory.

The conceptual model is tested for its applicability to a primary resource industry in the second part of the thesis. Survey scales are developed to quantify social resilience, resource dependency and policy perception, and to examine the relationships between them. One hundred commercial fishers and their families from five coastal communities (Cooktown, Port Douglas, Innisfail, Townsville and Bowen) are quantitatively and qualitatively surveyed. This 'mixed-method' approach provides an opportunity to combine the benefit of quantitative techniques, which condense data in order to better see patterns, with qualitative techniques, which enhance data to see key aspects of phenomena more clearly.

The response of commercial fishers to changes in fisheries policy was found to comprise four components. These were characterised as (i) a fisher's perception of the risk associated with a change in policy, (ii) their ability to plan, learn and reorganise, (iii) their proximity to the threshold of coping, and (iv) their level of interest in change. These components were found to be strongly influenced by resource dependency and policy perception.

A fisher's perception of the risk associated with policy change was found to be significantly correlated with the level of attachment to the fishing industry and the level of employability (measures of social resource dependency) as well as by a negative perception of policy change. A fisher's perception of the ability to plan, learn and reorganise correlated with the business size and approach (measures of economic resource dependency). A fisher's perception of their ability to cope is strongly related to their level of attachment to the occupation and employability, the business size and approach and the perception of policy change. In contrast, the level of interest in change was not observed to be significantly correlated with any aspect of resource dependency or perception of policy change.

Qualitative data revealed key mechanisms for the influence of resource dependence and policy perception on social resilience. Fishers that are especially dependent on the fisheries resource are limited in the flexibility with which they can approach policy change. Dependent fishers were characterised by a strong attachment to their occupation, older age, few transferable skills, a business approach that was 'lifestyle-oriented' and rarely involved employing others. These fishers can be limited through their attitude, employability, family, financial situation and capacity to develop innovative solutions. Fishers who are

meaningfully involved in the decision-making process are more likely to be resilient to policy change because they are more likely to understand and trust the need for change, and because they feel some control over their future.

An operational model of social resilience for resource industries such as the commercial fishing industry is developed on the basis of these results. The model provides insight as to what determines the resilience of socio-ecological systems, generally. It suggests that the nature of the relationship with the resource can influence the ability of resource-users to cope and adapt. Policy design and implementation are also found to have a significant role in maintaining system resilience.

This information is important for the management of socio-ecological systems. To successfully navigate through policy-change transitions, resource-users require flexibility (or low resource dependency) and a positive perception of policy change. This is especially true of the commercial fishing industry in North Queensland. This study has developed methods to measure these qualities, thus giving resource managers the ability to assess social resilience prior to the implementation of conservation initiatives. Understanding the influence of these qualities provides resource managers with knowledge of the important system properties that require management. This knowledge can underpin progressive management approaches aimed at more effective and equitable resource protection. For example, managers could use the approaches developed in this study to identify resource-users with a strong level of dependency on the resource. The resilience of these users could be increased prior to a policy change through assistance to develop skills to plan and reorganise, or to build capacity for alternative employment. Managing the perception of policy change is another important consideration. Resource managers may benefit from increasing the quality of communication with resource-users or by providing opportunities and incentives for resource-users to participate in policy design and decision-making processes. Improved knowledge of the linkages between people and the environment, and new tools such as those developed in this study, better position resource managers to meet the challenge of managing for resilient socio-ecological systems.

Statement of Sources

Declaration

This thesis is entirely my own work except where stated specifically. This work has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is provided.

Nadine Marshall

October 2005.

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Part A.

A Conceptual Development of Social Resilience within a Natural Resource Management Context

1

Chapter 1.
General Introduction

"It is not the strongest species that survive, nor the most intelligent, but the ones most responsive to change".
attributed to Charles Darwin, 'The Origin of Species'

1.1 The problem

Environmental issues such as increased salinity, erosion, acidification, biodiversity and diminishing natural resources are major concerns in Australia, as elsewhere around the world (Cochrane 2000). Increases in the demand for natural resources and the impacts of a growing world population on the environment have meant that more stringent policies that regulate the use of, or access to, natural resources are being implemented more frequently (Holling and Meffe 1996, Caddy 1999, Ostrom et al. 1999, Lane and McDonald 2002). However, natural resource managers that implement these policies work in complex social, environmental, economic, political and cultural systems that are inherently unpredictable and indeterminate (Levin et al. 1998, Scoones 1999, Davidson-Hunt and Berkes 2004). Consequently, resource policies are frequently applied without full knowledge of the likely consequences (Adger 2000, Wiber 2000, Berkes and Jolly 2001, Morrison et al. 2004).

Implementing resource-protection strategies without sufficient knowledge of the likely implications may impose levels of stress upon individuals, industries and communities to such an extent that their ability to adapt, tolerate or prosper under the new policy regime is compromised (Machlis and Force 1988, Levin et al. 1998, Stedman 1999, Wingard 2000). In addition, resource policies that are implemented without due consideration of the likely social consequences are often associated with intense conflict and can be ineffective in achieving resource protection (Maiolo et al. 1992, Roe 1996, Hampshire et al. 2004). Conflict arising from resource policies can also result in poor compliance with the requirements of the policies (Sutinen 1998, Sutinen and Kuperan 1999, May 2004). In their efforts to implement change,

natural resource management organisations frequently encounter resistance to their strategies: proposed policies are opposed, goals are frequently contested, public dissatisfaction surmounts, people refuse to participate and comply, animosity and distrust toward the government grows, appeals and litigation increase, and occasionally even threats and violence occur (LeBillon 2001, Sneddon et al. 2002, Lachapelle et al. 2003, Jabareen 2004).

The implementation of resource-protection policies is a political process (Lachapelle et al. 2003, Le Tissier et al. 2004, Manfredo and Dayer 2004, Mascarenhas and Scarce 2004). There is an urgent need to increase the effectiveness with which resource policies are implemented (Manring et al. 1990, Charles 1992, Maiolo et al. 1992, Jones 1999). Uncertainty and conflict surrounding resource policies may be reduced through a better understanding of the relationship that resource-users have with the resource that they depend upon for everyday living (Bryant and Wilson 1998, Anderies et al. 2004). In addition, since resource sustainability is vitally important for the sustainability of resource–dependent people, it is important to understand why resource-users erect 'barriers' to incorporating resource-protection policies into their working lives. This study represents an early attempt to quantify and understand the practical implications of altering the nature of the relationship between resource-users and a natural resource by policy change. This knowledge may significantly improve the way in which resource policies are designed and received: social impacts might be minimised and conservation goals might be maximised (Burdge and Robertson 1990, McCay 1996, Margerum 1999, Pomeroy 1999).

1.2 Resilience as a concept to assist in resource management

Resilience is an important concept that is emerging to guide and support more inclusive and effective approaches to the management of combined social and ecological systems (Ludwig et al. 1997, Berkes and Folke 1998, Levin et al. 1998). Resilience is the ability of socio-ecological systems to cope and adapt to change (Folke et al. 2002b). Resilient systems are adaptable, flexible and prepared for change and uncertainty (Gunderson 1999, Hughes et al. 2005). The concept of managing for socio-ecological resilience relates to the maintenance of system properties that confer resilience without compromising the ability to cope and adapt to future change (Holling and Meffe 1996, Holling et al. 1998, Holling 2004b). Managing for resilience is thus a means by which resource managers can design resource-protection strategies that allow socio-ecological systems to cope with disruptions (such as resource policies that regulate access to a resource) and adapt. Such management strategies are currently

being recognised for their effectiveness in protecting resource integrity and social sustainability (Lane and Stephenson 1997, Levin et al. 1998, Carpenter et al. 2001, Scheffer et al. 2001).

The concept of social resilience has been developed to various extents within medical, anthropological and psychological contexts (NIMH 2001). Within a natural resource management context, however, the properties that enable people to be adaptable, flexible and prepared for change and uncertainty are only just recently receiving attention within the literature (e.g. Folke et al. 2002a, b, Anderies et al. 2004). However, because social resilience is not easily observable and is frequently highly context-specific it is rarely successfully 'measured' and even more seldomly predicted (Adger 2000, Carpenter et al. 2001, Berkes and Folke 1998, Walker et al. 2002). Yet, the identification, assessment and prediction of the capacity of resource-users to cope with resource-policy change and adapt is desperately needed knowledge for the maintenance of socio-ecological systems (Folke et al. 2002a, Folke et al. 2005).

Furthermore, social resilience has been mostly defined at the community level (Levin et al. 1998, Adger 2000). A community-level analysis of social resilience, although vitally important to understand the concept at multiple scales, is potentially masking the fundamental underlying mechanisms that confer resilience: how people cope with policy change and adapt (Machlis et al. 1990, Freudenberg and Gramling 2002, Mascia et al. 2003, Trosper 2003b). For the concept to be truly practical it is important to understand social resilience at other levels of analysis (Meffe 2001, Adger et al. 2002, Manfredo and Dayer 2004). Emphasis on the role of policy change at an individual unit-of-analysis may progress our understanding of how resource-dependent people can increase their capacity to be resilient to future policy change (Smith 1995, Salz 1998, Smith et al. 2003, Bradley and Grainger 2004). However, the concept of 'individual resilience' has not been clearly defined so that it can be easily measured and assessed and the conditions under which it can be expected to alter are not understood.

The term, 'social resilience' in this study refers to individual resilience. It is not about the ability to bounce back from a medical or psychological condition (the individual level resilience concept as used in clinical psychology). And it is not about the ability to make a living in the face of adversity (the individual and household level resilience concept as used in development studies and livelihood analysis). It is a concept that describes the flexibility with which fishers can deal with fishery policy change and stay in the fishery, as opposed to being 'forced out of the industry. It could just as easily be called 'occupational mobility',

'occupational resilience' or 'employment resilience'. This definition encompasses that of Holling and the recent variations on it who advocate knowledge of resilience at various scales.

1.3 The commercial fishing industry as a case study

The commercial fishing industry in North Queensland provides an especially relevant case study to test and apply the concept of social resilience. Like other fisheries around the world (Hanna 1996, McCay 1996, Bailey 1997), the industry and fisheries resource is reaching a 'critical' stage where the ecological and social resilience of the system is threatened (Holling and Meffe 1996, Costanza et al. 2000). The status of several fisheries stocks within Queensland are currently listed as threatened (www.dpi.qld.gov.au/fishweb), and there is strong public pressure to further substantially reduce, if not remove altogether, commercial fishing within the Great Barrier Reef World Heritage Area (Howe 2002). Subsequently, the fishing industry has been at the centre of public debate over the sustainability of its activities for many years. During this time, there have been numerous attempts to curb associated environmental impacts and ensure environmental sustainability through the implementation of policies that regulate the use of, or access to, the fisheries resource (Hughey 2000, Howe 2002). Recently, for example, under the provisions of the Fisheries Act 1994, the Fisheries (East Coast Trawl) Management Plan was developed to ensure that the trawl fishery is managed in a sustainable manner ("The Trawl Plan 2002"). Policy changes were introduced such as a license buy-back scheme, unit allocations based on previous fishing effort and boat size, expensive penalties, gear modifications (such as turtle-exclusion devices and by-catch reduction devices), and fees for unit trade, license transfer and the upgrading of vessels.

Until recently, the commercial fishing industry was the eighth most valuable primary producer for Queensland, and the third largest commercial fleet in Australia (Hundloe et al. 2002, Williams 2002). In the year 2000, the Gross Value of Production (GVP) of the industry was variously valued between $295M-330M (McPhee and Loveday 2000, Williams 2002). The social significance of the industry to Queensland is also substantial. For the year 2000, Fenton and Marshall (2001a) estimated that there were 2,444 active fishing business operators or 'Masters License holders' in Queensland, with most businesses employing between two and three crew in addition to the Master Fisher. During the peak fishing season they estimated that there were 7,088 full-time equivalent employees whilst in the off-peak season these numbers were reduced to approximately 6,100 employees.

The industry consists of trawl fishers, line fishers ('reef-line fishers"), crabbers and netters, all of which are of interest in the current study. Many fishers hold a multiply endorsed license which means that a line fisher, for instance, may also trawl or net (Fenton and Marshall 2001).

The industry is managed by the Queensland government through the Queensland Department of Primary Industries and Fisheries (QDPI&F) (known formerly and in this study as the Queensland Fisheries Service (QFS)). The Great Barrier Reef Marine Park Authority (GBRMPA) is a federal agency that also contributes to fisheries management through restricting fishing activities by zoning within the Great Barrier Reef Marine Park. Each commercial fishery is also subject to specialist Management Advisory Committees (MACs) devoted to management issues, with representatives from state and federal agencies, other interested groups (marine scientists, representatives from recreational fishers and the marine tourism industries) as well as industry representatives (Queensland Seafood Industry Association).

As in many other countries around the world such as Canada, Europe and the USA (Wilson et al. 1994, Milich 1999, Coghlan 2002), very little other social data are available to assist fisheries managers in Queensland to develop strategies to maintain socio-ecological resilience of the industry (Fenton and Marshall 2001a, Fenton and Marshall 2001b, c, Howe 2002, Hundloe et al. 2002, Williams 2002). Social data are not explicitly considered within the management process, although economic considerations are made (www.dpi.qld.gov.au/fishweb). The commercial fishing industry in Queensland is mostly managed using ecological knowledge. Generally, the industry is managed by constraints (or 'input controls') on the number of vessels (limited entry), time and place of fishing and/or the type and specification of both vessel and gear. There are also controls on what can be harvested ('output controls') such as the level of catch (e.g. total allowable catch), restrictions on the length and the sex or maturity of stages that can be taken (Williams 2002). The Queensland Department of Primary Industries and Fisheries (QDPI&F) collect daily data from each fishing operation through the use of compulsory logbooks, which commenced (as a voluntary program) in 1988. The data collected include the location fished, the catch by species, the weight harvested, the fishing gear used, and depending on the fishery, the time spent fishing and other effort measures. These data are used to assess the status of fisheries in Queensland as well as to assist in the management process.

Commercial fisheries in Queensland extend from the Northern Territory border in the Gulf of Carpentaria around Cape York, throughout the Great Barrier Reef and south to the New South Wales border (see figure 1.1). At the time that this study was implemented, the "The Trawl Plan 2002" had been implemented, "The Line Plan" had been drafted and "The Representative Areas Programme" had been proposed in which the Great Barrier Reef rezoned the areas available within which to fish commercially from 5% to 33% (www.gbrmpa.gov.au).

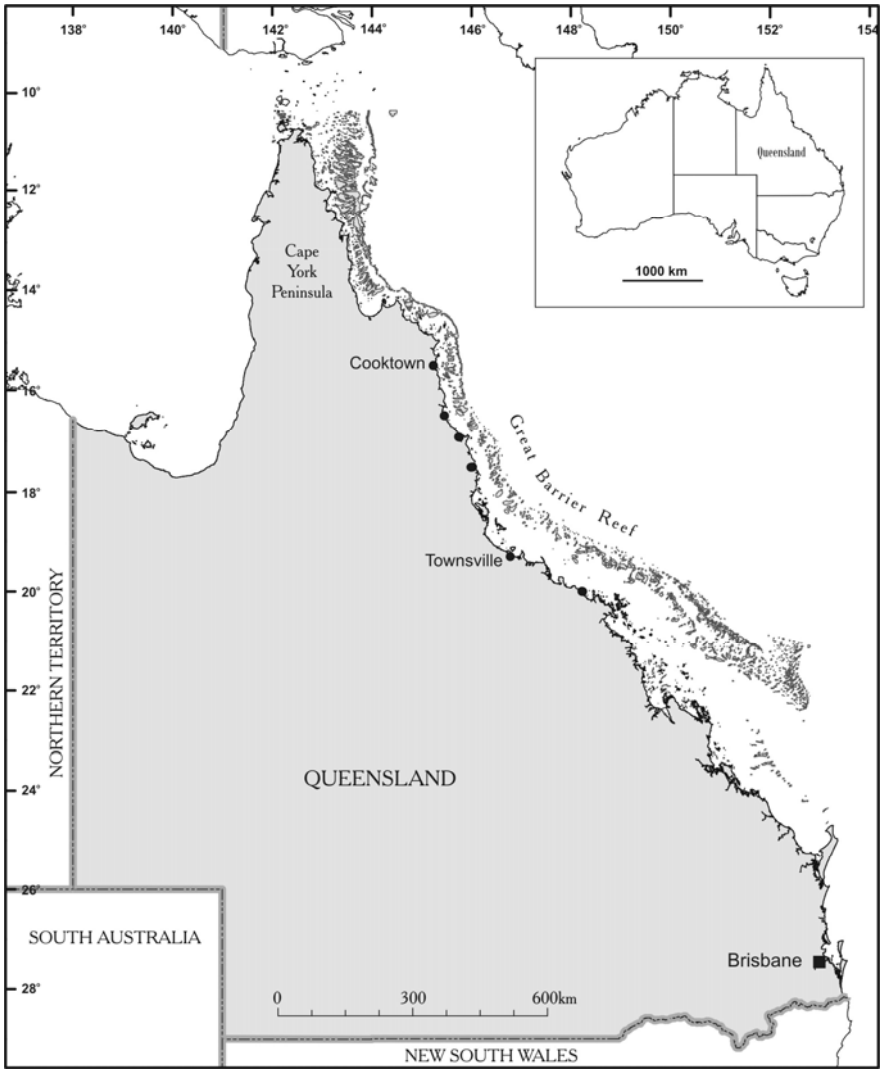


Figure 1.1 Map of Queensland showing the extent of the coastline available to commercial fishing.

1.4 General aims and significance of the study

Although commercial fishers in North Queensland are frequently exposed to institutional changes regulating how they can use or access the fisheries resource, our understanding of their ability to cope and adapt, or be resilient, remains limited. A better understanding of the response of fishers to generic institutional change is important because it reveals the mechanisms by which change influences the structure and dynamics of resource-dependent industries and communities. Additionally, knowledge of the factors that determine the response of fishers to institutional change can help identify and refine strategies to effectively manage the fisheries social and ecological system.

This thesis aims to improve our understanding of several aspects of resilience to institutional change within a natural resource management context and with specific reference to the commercial fishing industry. These aspects include: (i) the definition and assessment of how commercial fishers respond to institutional change, (ii) the factors that determine the vulnerability of fishers to institutional change, and (iii) the ability of commercial fishers to survive and adapt (resilience) to the requirements of institutional change.

The aims of the study were:

(i) To define and conceptualise social resilience at the individual level

(ii) To define and conceptualise potential influences on individual resilience

(iii) To develop a conceptual model of social resilience that can predict and provide guidance on the social consequences of proposed policy options through knowledge of the characteristics of individuals

(iv) To operationalise the conceptual model by testing and applying the model to the commercial fishing industry in North Queensland

(v) To provide resource managers with a tool for assessing the social resilience of resource-users to future policy change (thus enabling comparison of the social consequences of different policy options) and to provide insights for enhancing social resilience in the context of natural resource management.

1.4.1 Thesis overview

This thesis is presented in two main sections. The first half of the thesis is a conceptual development of the social resilience of resource-dependent communities to changes in resource policy. The second half of the thesis provides evidence from the commercial fishing industry in North Queensland to support or modify the conceptual model developed in the first half. Each chapter is outlined below.

Part A. A Conceptual Understanding of Social Resilience to Policy Change

Chapter 1. Introduction. This chapter is an overview of the research problem, the approach taken to address the problem, the limitations of current approaches and the need for a new approach.

Chapter 2. A conceptual understanding of social resilience to policy change. This chapter is a review of the current state of knowledge of social resilience: how it is defined, recognized and measured in other contexts. A major finding of this chapter is that social resilience has been poorly conceptualized within a natural resource management context.

Chapter 3. A conceptual understanding of the influence of resource dependency on social resilience. This chapter develops a conceptual understanding of the likely social consequences of altering the relationship between resource-dependent people and the resource.

Chapter 4. A conceptual understanding of the influence of policy change on social resilience. This chapter develops a conceptual understanding of how policy design and delivery can enhance or erode social resilience.

Chapter 5. A conceptual development of social resilience to policy change. This chapter integrates knowledge from the previous chapters to develop a comprehensive conceptual model to be tested in Part C for its applicability to the commercial fishing industry in Queensland and to refine and improve its generality.

Part B. An Operational Understanding of Social Resilience to Policy Change

Chapter 6. Operationalising the concept of social resilience for the commercial fishing industry. This chapter presents the methods used to test the conceptual model. One hundred fishing families in five coastal communities in North Queensland were qualitatively interviewed and quantitatively surveyed to assess their likely response to generic policy change, their level of dependency on the resource and their perception of policy design and delivery.

Chapter 7. Defining social resilience: Results I. This chapter presents an assessment of the social resilience of commercial fishers to policy change. 'Social resilience' is defined, quantified and discussed.

Chapter 8. The influence of resource dependency on social resilience. Results II. This chapter shows how the level of resource dependency can influence the social resilience of commercial fishers to policy change. 'Resource dependency' is defined, quantified and discussed.

Chapter 9. The influence of the perception of policy design and delivery on social resilience. Results III. This chapter shows how the perception of policy design and delivery can influence the social resilience of commercial fishers to policy change. 'The perception of policy design and delivery' is defined, quantified and discussed.

Chapter 10. General Discussion. Results of the study are discussed in terms of how they progress our understanding of social resilience in a natural resource management context. Conclusions are made with reference to managing natural resources for socio-ecological resilience.

Chapter 2.
A Conceptual Understanding of Social Resilience to Policy Change

"But on you will go though the weather be foul
On you will go though your enemies prowl....
On and on you'll hike, and I know you'll hike far
And face up to your problems wherever they are....
So be sure when you step, step with care and great tact
And remember that Life's a Great Balancing Act.
And will you succeed?
Yes! You will, indeed!
(98 and 3/4 percent guaranteed.)"
Dr. Seuss, "Oh! The Places You Will Go!!"

2.1 Introduction

How can we measure social resilience to changes in resource policy? The management of our natural resources, so that they can sustainably provide for current and future generations, is becoming a most urgent issue (Barry and Oelschlaeger 1996, Levin et al. 1998, Kates et al. 2000, Dayton 2003). Historically, the management of natural resources has been characterized by a 'command-and-control' approach (Low et al. 2004) based on ecological ideas such as the Maximum Sustainable Yield (MSY) used in fisheries management and Carrying Capacities used in recreational settings (Rosenberg et al. 1993, Norton 1995, Holling 1996, Ives et al. 1999). These concepts view ecosystems as stable entities that are capable of providing expected and constant yields and responding predictably to human-use (Ehrich 1994, Powell 1999, Folke et al. 2002a, Trosper 2003b). Rockstrom (Rockstrom 2003) describes this approach as the search for a 'Human Nirvana': an optimum point where resources can be extracted at a rate that is balanced with the capacity of the resource to deliver similar goods and services in the future. The approach, however, does not consider the highly variable, complex, non-linear and dynamic nature of resource systems, nor the complex interaction that exists with the similarly highly variable, complex and dynamic behaviour of human-beings

(Ludwig et al. 1997, Berkes and Folke 1998). Where 'sustainable yields' or quotas have been set, resources and their dependent social systems have collapsed or are close to it (Ayensu et al. 1999, Milich 1999, Jackson et al. 2001, MacKenzie 2003). Convincing evidence exists to suggest that this approach can inadvertently erode the ability of systems to cope with change and adapt (Gunderson 1999, Rockstrom 2003, Seixas and Berkes 2004).

Complex Systems Theory has subsequently emerged that challenges how we view natural systems (Allison and Hobbs 2004, Cumming and Collier 2005). It incorporates the highly variable, complex, non-linear, coupled and dynamic nature of socio-ecological systems (Holling 1986, Abel 1998, Folke et al. 2002c, Gunderson et al. 2002). From this, the concept of resilience has developed (Holling 1973, 1996). Resilience represents a property that sustains social and ecological systems and is the capacity of a system to absorb change and reorganise so as to retain essentially the same function, structure, identity and feedbacks. Resilience theory suggests that social and ecological ('socio-ecological') systems are intrinsically coupled and constantly face change (Abel and Langston 2001, Gunderson and Holling 2002, Allison et al. 2003, Colding et al. 2004). Resilient systems are able to undergo change (such as resource extraction) and adapt; up until their thresholds of coping are reached. If thresholds are crossed, resource systems are apt to lose resilience and collapse. Hence predicting the optimum point where resources can be extracted at a rate that is sustainable is fraught with danger. Instead, resilience theory predicts that through the maintenance of properties that can confer resilience, sustainability of natural resources and the social systems dependent upon them is possible and essential for the prosperous development of society (Gunderson 1999, Kates et al. 2000, Gunderson et al. 2002, Walker et al. 2002).

Resilience theory has been developed over the last thirty years (Holling 1973, 2004a). The practical application of the theory, however, is only more recently receiving attention (e.g. Seixas and Berkes 2004, Folke et al. 2005, Olsson et al. 2005). An inherent difficulty in the application of the concept to the management of natural resource that has transpired is that resilience is imprecise, difficult to define and hence rarely successfully ever 'measured' (Adger 2000, Folke et al. 2002a, b, Walker et al. 2004). However, in order for the concept to be truly practical, researchers and resource managers require knowledge of the proximity of systems to their thresholds of coping and the capacity of systems to be resilient to change. Resource managers need to know how much change a system can absorb before it loses resilience.

The resilience of the social system linked to resource systems is now understood to be just as important to manage as the resilience of the ecological components of the system (Berkes and Folke 1998, Gunderson 1999, 2000, Berkes et al. 2003). Loss of social resilience has been linked to loss of ecological resilience (Levin et al. 1998, Ostry 1999). Hence defining, measuring and predicting social resilience within a socio-ecological system is vital knowledge for the successful management of natural resources. However, resilience of the social components of socio-ecological systems, have received relatively little attention and are subsequently poorly conceptualised and defined (Folke 2001, Folke et al. 2003a). In fact, the way in which human components respond to changes within the resource system is described as the component that is least understood (Carpenter and Gunderson 2001). Social scientists have been developing the concept of social resilience for some time in order to understand the processes and consequences of change within other contexts (e.g. medicine, psychology, anthropology, community development) (Brooks and Adger 2004), however, relatively little effort has been made to make use of this knowledge, combine it with resilience theory and incorporate it into developing a conceptual understanding of social resilience within a natural resource management context. The aim of this chapter is thus to develop a conceptual understanding of what social resilience is, and how it can be measured (or 'operationalised') by combining the merits of both resilience theory as well as social theory.

2.2 Conceptualising resilience within a socio-ecological context

Since Holling's seminal paper presented in 1973, the concept of resilience has evolved considerably (Walker et al. 2004). It is a concept that is defined as having multiple attributes. For example, in 1973 it was described on the basis of three defining characteristics: (i) the amount of disturbance a system can absorb and still retain the same structure and function ('state' or 'regime') (ii) the degree to which the system is capable of 'self-organisation' and (iii) the degree to which the system can build and increase the capacity for learning and adaptation (each of which are described below) (Carpenter et al. 2001, Folke et al. 2002a,b). More recently, other attributes are also recognised as being important to describe in defining resilience. Walker et al. (2004), for example, highlight four aspects that they believe are critical in defining resilience: (i) latitude, (ii) resistance (iii) precariousness and (iv) panarchy (each of which is described in detail below). Although other commonly used definitions are also used to describe resilience (e.g. the amount of change that a socio-ecological system can absorb before switching from one set of 'desirable' processes and structures to an alternative set of

'undesirable' processes and structures (Peterson 2000, Adger et al. 2002, Folke and Gunderson 2003b), the general principles remain the same: the greater the resilience of a system, the greater its ability to cope with change and adapt (Holling et al. 1998, Folke et al. 2002a, b).

A recent interpretation of resilience uses a 'stability landscape' to illustrate the concept (Walker and Meyers 2004). This term describes the state of a system. For example, the boundaries and variables that describe a fisheries resource system are descriptions of the stability landscape. The landscape can be visualised as a "valley" and is referred to as a domain, regime or basin (figure 2.1). The dimensions of the valley over several scales and dimensions are the important measures of resilience. Some stability landscapes may have more than one valley to best describe their state. Each state has its own set of processes and structures that play out over several scales of space, time and organisation and with complex and varied linkages between the social, ecological and economic components of the system (Walker and Meyers 2004). Figure 2.1.a shows that while a system is undisturbed it tends towards its lowest energy state, that is, the bottom of a valley. Figure 2.1.b shows that a system that is disturbed will move towards its threshold of coping. A system that crosses its threshold of coping loses resilience and will switch into a new valley or state of processes and structure. In order to describe how social resilience might be described, it is firstly necessary to introduce some related attributes associated with stability landscapes: adaptive cycles, thresholds, adaptability, transformability, latitude, resistance, precariousness and panarchy (Walker et al. 2002).

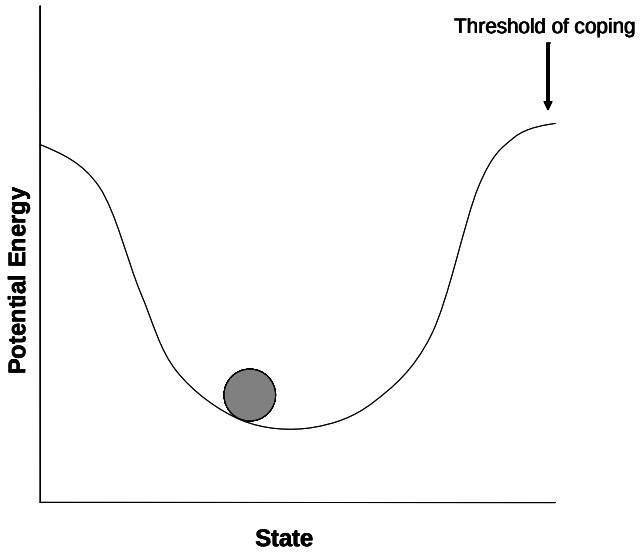


Figure 2.1.a. A description of the resilience of a socio-ecological system using a stability landscape of one valley or basin. The ball represents the current position or state of the system within the boundaries of the valley.

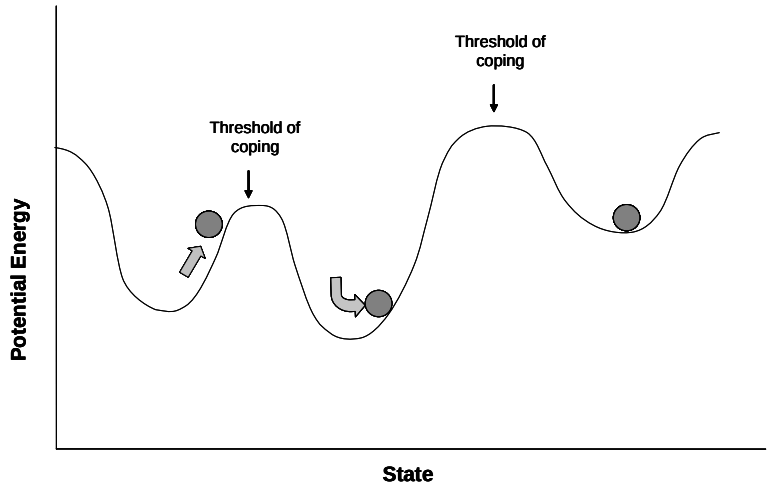


Figure 2.1.b. A system that is disturbed can switch into a new valley or state of processes and structure as it crosses its threshold of coping.

2.2.1 Adaptive cycles and panarchy

Social and ecological systems are intrinsically linked. The combined socio-ecological system continually faces challenges in the form of change-events, the outcomes of which are inherently unpredictable. The processes through which socio-ecological systems undergo change are described in terms of a cycle, known as an adaptive cycle, which pass through distinct phases. The cycle is initiated by a change-event that resets or 'collapses' the system. The cycle then proceeds into a recovery or growth phase, during which innovation and new opportunities are possible, which then develops into a conservation phases in which the system becomes increasingly 'locked up' and less flexible and responsive to external shocks. The system is eventually and inevitably followed by a chaotic collapse (visualised as an unpredictable 'backloop' see (Holling 2004a) which rapidly gives way to the system being reorganised and starting again (Holling 1973, Abel and Langston 2001, Folke et al. 2002a, b, Colding et al. 2004).

Importantly, these adaptive cycles exist at a number of scales in time, space and levels of organisation, and interact across these multiple scales ('panarchies'). These cross-scale effects are of great significance in the dynamics of socio-ecological systems where it is not possible to

understand a system at only one scale (Holling 2004b). Aspects of resilience are influenced by what is happening in the panarchy at scales above and below the scale of interest (Walker et al. 2004). Hence, adaptive cycles are variable, complex, non-linear and dynamic: the outcomes of change events affecting the system are inherently unpredictable.

2.2.2 Thresholds

Socio-ecological systems possess marked thresholds which determine whether they will switch from a 'desirable' state into an 'undesirable' one (Walker and Meyers 2004). Systems can shift dramatically and often irreversibly between states, depending on how close they are to their 'thresholds' and how large the change-event is (Folke et al. 2002a, b). A sufficiently large change event can cause a system to switch to an alternate state if the thresholds of coping are reached and exceeded. For example, clear freshwater systems can become turbid (Carpenter and Gunderson 2001), coral reefs can become algal-dominated (Nystrom et al. 2000) and abundant fisheries can become depleted (Berkes and Folke 1998, Walker and Meyers 2004). Such negative shifts from 'desirable' to 'undesirable' states represents loss of system resilience.

Measurements of thresholds typically have low precision, and often thresholds shift over time due to the complex and dynamic behaviour of these systems. In fact, thresholds are believed to change so rapidly that it is difficult to design assessment programs that can develop as quickly as thresholds change (Berkes and Jolly 2001, Folke et al. 2002a).

2.2.3 Adaptability

Adaptability refers to the capacity of people ('actors') within a system to influence or manage resilience, either intentionally or unintentionally. The collective capacity to manage resilience determines whether systems can successfully avoid crossing into an undesirable regime in response to a change event. Actors can move thresholds closer or further away, or make them more or less difficult to reach depending on their adaptability (McCay 1981, Walker et al. 2004).

2.2.4 Transformability

When the social, economic, or ecological conditions under which socio-ecological systems are expected to adapt become untenable, a system may transform into a fundamentally new system that is not necessarily 'undesirable'. This capacity requires the introduction of new

components that define the system, for example by introducing new ways of making a living (Folke et al. 2002a, b, Olsson et al. 2004, Walker et al. 2004, Folke et al. 2005).

2.2.5 Latitude

Latitude refers to the maximum amount the system can be changed before losing its ability to recover to maintain the same function, structure, identity and feedbacks (Walker et al. 2004). Latitude can be visualised in figure 1 as the width of the valley that describes the current state of a system. A wider valley means a greater number of states can be experienced without crossing a threshold.

2.2.6 Resistance

Resistance relates to the difficulty in changing the system (Allison and Hobbs 2004, Walker et al. 2005). Resistance can be visualised in figure 1 as the depth of the valley that describes the current state of a system. Deeper valleys require a greater force (or potential energy) to move a system closer to its threshold and into another regime or state.

2.2.7 Precariousness

Precariousness refers to the proximity of a system to its threshold. Precariousness can be visualized in figure 1 where the "ball" pinpoints the current position or trajectory of the system and how close it is to the top of the valley (Walker et al. 2004).

2.3 Incorporating social theory into resilience theory

Conceptualizing, measuring and predicting social resilience within a natural resource management context is difficult (Adger 2000). Although social resilience is mostly specified within the context: 'of what, to what' (Carpenter et al. 2001, Walker et al. 2002), researchers have been mostly vague about what it is they have set out to measure. Whilst some researchers attempt to describe social resilience in terms of where a system currently is (Harkes and Novaczek 2002), other researchers describe where a system ought to go (Gunderson 1999, Lane and MacDonald 2002), or where a system has been (Gadgil et al. 2004). Other researchers describe how to encourage a system to move along a specific trajectory (Folke et al. 2005) or how to transform into an entirely new system (Olsson et al. 2005). That is, researchers have attempted to describe social resilience as either an outcome or a process.

The rather vague approach to conceptualising social resilience within a natural resource management context has probably resulted from the disparate theoretical foundation. Abel (1998) describes how anthropologists are currently developing approaches that explicitly link social behaviour with ecological conditions in order to address specific problems of resource management. He suggests that ecologists need the insights of anthropologists for understanding the functional and ecological relationships that exist between human culture and the environment and between people, and that anthropologists need a better understanding of the ecological processes that describe complex ecosystem dynamics. Anthropologists are combining Complex Systems Theory to social theory using concepts such as 'cultural evolutionary theory', 'political anthropology', and 'resource capture, use and re-use' (Buttel 1987, Abel 1998, Scoones 1999, McCay 2000). Ecologists are incorporating the notion that humans are integral components of natural systems and are attempting to better understand how the characteristics of people can influence the resilience of resource systems (Folke et al. 2003a). Nevertheless, a model that provides practical assistance to researchers and resource managers alike is still within its infancy.

The combined effort between the sociological and ecological disciplines is advancing our knowledge of how resource-users respond to changes affecting the coupled socio-ecological system. However, researchers have still not as yet satisfactorily conceptualised what social resilience is and how it can be measured for the purposes of resource management. Researchers from both disciplines alike have grappled with the concept in a seemingly 'ad hoc' manner, depending on the discretion of the researchers measuring it (Nadeau et al. 1999, Lane and McDonald 2002, Hiedanpaa 2005). The result has, for the most part, been highly context-dependent and outcome focused. For example (Harris et al. 1998) looked at the ability of a small town to manage change and adapt to it in positive ways. They developed a community resilience index based on aggregate measures of resident's perceptions of their community's characteristics and conditions. (Bliss et al. 1998) looked at the resilience of a timber-dependent community to economic changes, and used the number and diversity of forest companies (mills etc.) as a measure. (Machlis and Force 1988), in looking at the resilience of resource-dependent communities to changes in resource production levels, used employment and income levels, price levels, company profits, bank deposits, property valuations, level of non-market goods and services as measures of social resilience. Although these examples define, measure and predict the social consequences of change, they are extremely case-specific and

do little to progress our knowledge of what social resilience is and how it can be applied to the challenges of resource management.

Nonetheless, there are some key aspects of social resilience that have been discussed in other contexts that can be useful in developing an integrated conceptualisation of social resilience within a natural resource management context (Sonn and Fisher 1998, NIMH 2001, King 2005). These aspects include: adaptive capacity, social capital and community empowerment and well-being.

2.3.1 Adaptive capacity

The ability of a system to be resilient to change is a function of its adaptive capacity. Adaptive capacity refers to the ability of a system to cope with novel situations without 'losing options for the future' (Brooks et al. 2005). It reflects learning, the flexibility to experiment and adopt novel solutions, and the ability to respond generally to a broad range of challenges (Levin et al. 1998, Gunderson 2000). Adaptive capacity refers to the ability of individuals or communities to adapt to adversity and stressful life events by 'reorganising' through networks or institutions that learn, store knowledge and experience, and that are creative, flexible and novel in their approach to problem solving (Vayda and McCay 1975, McCay 1981, Sonn and Fisher 1998).

2.3.2 Social capital and community empowerment

Social capital and community empowerment reflect the level of social interaction, social networks and social relations that exist within a community (Putnam 1993, Worthington and Dollery 2000, Adger et al. 2002). Communities with increased stocks of social capital typically have reciprocal networks of community interactions and increased social trust that are directed towards mutual benefit (Cernea 1993, Hofferth and Iceland 1998, Dasgupta and Maler 2001, Brunckhorst 2002). Social capital includes knowledge and mutual obligation, and is developed through social learning. The level of social capital within a community provides some indication of the capacity for a community to cope with change and adapt (Korpi 2001, Meffe 2001, Tindall and Wellman 2001, King 2005). Social capital and community empowerment are relatively easy to define and measure. They help to explain the ease with which change events are accepted and incorporated into people's lives. Individuals with stronger, more informed and more effective networks are regarded as being more resilient to generic change events than those with weaker ties (Mitchell 1974, Flora and Flora 1993, Putnam 1993).

2.3.3 Well-being

Well-being is defined as the satisfaction of the needs and wants of people (Jacob and Willits 1994). The concept of well-being is frequently associated with the ability to cope and adapt (SAFPS 1997, Sonn and Fisher 1998). Well-being may be a crucial indicator of a social system's resilience. Well-being is related to social capital at an individual level (King 2005). Government agencies and researchers in the US, Britain and France have been working on the development of social indicators of well-being since the late 1960s, since the concept of well-being is a generally useful indicator of current social conditions (Wismer 1999). The concept of well-being has not, however, been successfully incorporated into the concept of resilience within a natural resource management context (SAFPS 1997, Abel 1998, McCubbin 2001).

2.3.4 Social thresholds

Researchers associated with the resilience alliance (www.resalliance.org) argue that there is no point in actually measuring social resilience since thresholds are apt to change more rapidly than measurements of the system can be taken (Folke et al. 2002a, b). They imply that it is more important to develop social tools that focus on building adaptive capacity and identifying desirable trajectories rather than defining, measuring and predicting social resilience. They develop these tools by comparing and contrasting resource systems that have both failed and succeeded in achieving resource sustainability (Walker et al. 2004, Folke et al. 2005, Olsson et al. 2005). Desirable trajectories, or resilient systems, are assessed on a qualitative basis (Walker et al. 2004, Folke et al. 2005, Olsson et al. 2005). For example, they assess whether social resilience has been demonstrated by examining the success with which transformation to more 'desirable' states have been achieved. The researchers found that flexibility, learning, reorganizing, developing and experimenting were essential components in building the capacity of social systems to be resilient (Kay et al. 1999, Mathis 1999, Batisse 2000, Folke et al. 2002a). These components can be nurtured and conserved using social tools such as structured scenarios and active adaptive management strategies (Becker 1988, Berkes and Folke 1998, King 2000, Folke et al. 2002a, Folke et al. 2005).

Structured scenarios are developed in conjunction with community participants to visualize pathways to alternative futures. Futures that attain or avoid particular outcomes can be identified, and the necessary resilience-building policies can be designed and implemented to ensure that the desired pathway is the one travelled (Becker 1998, Folke et al. 2002, Ogilvy

2005). Active adaptive management increases the adaptive capacity of a system through experimenting with different strategies, learning from strong feedback loops and incorporating new information into the design of new strategies (Gunderson et al. 1995, Folke et al. 2002a, b, Olsson et al. 2005).

Although thresholds distinguishing between desirable and undesirable regimes may be in constant flux due to the inherent complexity and dynamic nature of complex, coupled socio-ecological systems, identifying thresholds and measuring the proximity of social systems to them is vital information for the successful management of natural resources. In order to manage for socio-ecological resilience resource managers require knowledge of the current capacity of the resource system to absorb change, what the current trajectory is and what is needed for this current trajectory to be altered onto some more desirable trajectory.

2.4 A conceptual model of social resilience

A conceptual understanding of social resilience is integral to an operational understanding of social resilience. Prior to launching into a definition of social resilience that incorporates the merits of both resilience theory and social theory, it is important to recognize that there are limitations to any measurement of social resilience. In this section, social resilience is conceptualised on the combined merits of social theory associated with natural resource management (Adger 2000, Adger et al. 2002) and resilience theory (e.g. Holling 1973, Levin 1998, Walker et al. 2002).

On the basis of resilience theory presented in this chapter thus far, social resilience for a resource industry can be conceptualised as comprising a point of 'precariousness' within a valley or basin that has 'latitude' and 'resistance'. The valley is bounded by 'thresholds' and a multitude of trajectories are possible in response to a change-event disturbing the system. These trajectories depend on the dimensions of the valley latitude and depth. They represent the 'adaptability' of the system and to some extent, the 'transformability' of the system (Holling 1986, 2004b).

On the basis of social theory presented, the point of precariousness can be described by the level of 'well-being' which reflects whether the current regime is 'desirable' or 'undesirable'; the latitude and resistance of the system can be described by the level of 'social capital and community empowerment' (other variables are also possibly important); the adaptability of the

system (which describes the possible trajectories that can be taken), can be described by the 'flexibility' and capacity to drive a system along a certain trajectory. For example adaptability might be described by the ability to reorganise, learn, be creative, flexible and novel in the approach to finding solutions (Carpenter et al. 2001, Folke et al. 2002). Describing thresholds, however, is more difficult, but they are related to the boundaries separating 'desirable' and 'undesirable' valleys or regimes (Ludwig et al. 1997, Anderies et al. 2002). It is proposed that well-being, as assessed by those experiencing the event, may be the most suitable measure of the desirability of the end-state.

For the concept to be truly practical, the dimensions of the current 'valley' are necessary to measure and describe. A good predictor of social resilience will provide information about the current state of the system, whether the size of the valley is becoming/will become smaller as a response to a change or proposed change, and whether the system is moving/will move closer to its thresholds. Measuring the actual variables will be context-dependent and will themselves have to change over time because of the inevitable changes that are inherent in complex systems. Figure 2.2 illustrates a way to conceptualise social resilience within the commercial fishing industry that provides information about the current state of the system, whether the size of the valley is becoming smaller, and whether the system is moving closer to its thresholds.

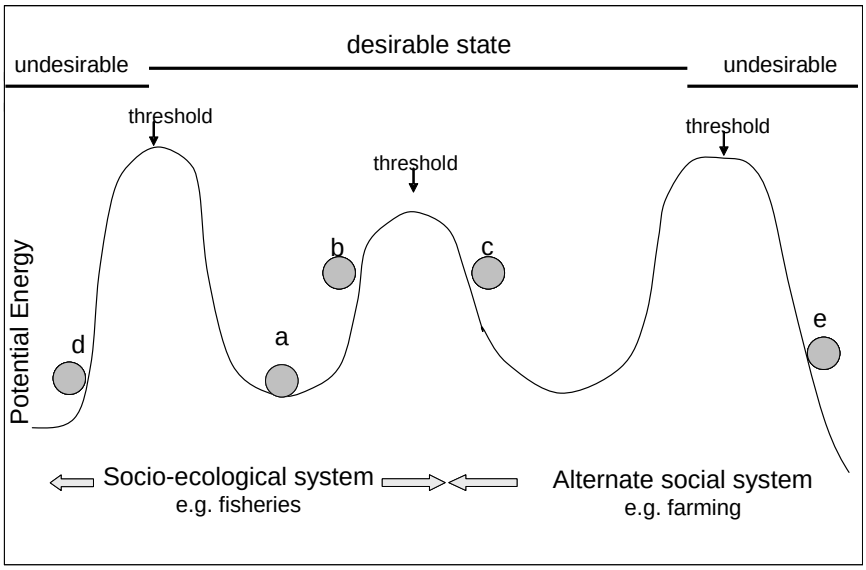


Figure 2.2 A conceptual understanding of social resilience for a resource industry such as the commercial fishing industry developed from figure 1. A desirable state can span the resource

system and beyond. Positions a, b, c, and d represent positions of precariousness as described within the text.

When faced with a change in policy that restricts use or access to the fisheries resource, commercial fishers have many choices as to how they may respond. A fisher (who are all male in this study) will assess his precariousness as the result of a proposed change in fisheries policy (position a, figure 2.2) and make decisions accordingly (Gramling and Freudenberg 1992). A fisher may be able to incorporate the requirements of the policy change into his working life and continue within the same regime or valley (position b). The valley may have become smaller, or he may be closer to his threshold of coping. This knowledge needs to be collected from people experiencing the change. Nonetheless, if fishers report a high level of well-being, they are demonstrating resilient properties and can be assessed as being 'socio-ecologically resilient'.

A fisher may decide that the ecological, social or economic conditions within the existing system, or proposed system, have become untenable (Walker et al. 2004). If a fisher decides to become a farmer, for instance, he may still be demonstrating resilient properties at a societal level ("social resilience"), although he is not demonstrating resilience within the resource system ("socio-ecological resilience"). He has shifted from the fisheries resource system into the broader societal system (position c, figure 2.2). He has shown the capacity to re-organise and has undergone a social transformation (Holling 2004, Olsson et al. 2004, Trosper 2003b). A fisher that becomes a farmer as a result of a change in fisheries policy and continues to earn a similar income might perceive the alternate state ('not fishing') as being equally 'desirable'- especially if he is earning a comparable income and enjoying similar lifestyle rewards. A farmer who is paying the same tax, for instance, as when they were a fisher is socially resilient since he is maintaining the same function at a societal level. He may thus report the same level of well-being, and hence his level of precariousness is unchanged. They are assessed as being "socially resilient". This definition of social resilience refers to that of Adger et al. (2002) who describe social resilience as, "the ability of communities to absorb external changes and stresses while maintaining the sustainability of their livelihoods" (p358).

Importantly, however, it may be possible to remain within the commercial fishing industry after a policy change and be unresilient: a fisher might remain within the fishing industry not because he is demonstrating an ability to cope and adapt and be resilient, but because he lacks other employment opportunities. These fishers are defined here as 'socio-ecologically

unresilient' and have entered into an 'undesirable' state even though they appear to be maintaining their structure and function within the resource-extractive industry (position d, figure 2.2).

2.4.1 Operationalising social resilience within the commercial fishing industry

The extent to which commercial fishers are resilient to changes in resource policy can be measured using self-assessment techniques that measure the expected level of 'well-being' to policy change. Fishers that remain within the industry after a policy change and report a high level of well-being are exhibiting socio-ecologically resilient properties (position a & b, figure 2.2). Fishers that remain within the industry but do not report a high level of well-being are socio-ecologically unresilient to changes in fishery policy (position d, figure 2.2). However, fishers that exit the industry and report a high level of well-being are socially resilient, (even though they are socio-ecologically not resilient) (position c, figure 2.2). Those that report a low well-being outside of the industry are not socially (or socio-ecologically) resilient (position e figure 2.2). The 'desirability' of the end-state (as measured by those experiencing the event) is thus the important measure to determine whether thresholds have been crossed and whether resilience has been demonstrated, and whether thresholds might be crossed.

The thresholds defining the boundary between desirable and undesirable states are thus possibly best described by the level of well-being. For example, if the concept of well-being could be measured by considering the level of flexibility of resource-users and their confidence in the future, then it might be possible to determine how close they are to their thresholds of coping. In this way, social resilience could be regarded as an outcome and as a process. Use of the concept of well-being (at the individual level of analysis) allows researchers and resource managers to obtain information about the current state of the system and whether the system is moving closer to its thresholds. The disadvantage of the concept, however, is that it measures resilience regardless of the boundaries of the resource system. It measures the desirability of the end-point, which spans both the resource system and beyond (figure 2.2). That is, the ramifications of a change in resource policy can extend beyond the confines of the resource system.

Chapter 3.
The Influence of Resource Dependency on Social Resilience

3

"We must never feel that it is okay to say that a sucker fish is of more value under law than a farm family."
--Gordon Smith Oregon Senator, protesting the federal government's decision to cut off an irrigation project that is the primary source of water for 250,000 acres of mostly family-owned farmland in the Klamath River Basin in California and Oregon.

3.1 Introduction

How can we measure the influence of resource dependency on social resilience? From the earliest times, humans have depended intimately and fundamentally on the natural environment. The environment has provided biological essentials such as water, air and minerals; resources and products such as food, fuels, fibres and pharmaceuticals; ecological services such as climate regulation, soil formation and nutrient cycling; and a host of aesthetic and cultural services such as the provision of shelter, artistic inspiration and recreational opportunities (Daily et al. 2000, Pajak 2000, Balmford et al. 2002). The sustainability of the environment is dependent on the types and levels of human use (Proshanksy 1976). There is also reciprocity in this relationship: the very existence of many species used in agriculture, for instance, is now heavily dependent upon the continuation of human farming practices.

The complex and reciprocal relationship that humans have with their environment is common to all organisms. All organisms have intimate physical, biological and social relationships with their surroundings, and all have had to adapt to living within the ecological limits of their environment, or have evolved means to actively modify their environment to increase their chances of survival (Buttel 1987, Clark 1990, Farmer and Albrecht 1998, Holling et al. 1998). Of all organisms, humans have evolved the greatest capacity to change their environment with the development and application of various technologies (e.g. agricultural, medical, chemical, astronomical etc.) (Ayensu et al. 1999).

The relationship between people and the environment is often used to explain constraints on the growth and well-being of human societies (Buttel 1987, Peluso et al. 1994, Folke et al. 2003a). A healthy and productive environment, and the ability to effectively utilise its resources, enables societies to grow and prosper. A healthy and productive environment provides a basis for economic and cultural diversification and encourages social improvements such as an enhanced quality of life (Force et al. 1993, Humphrey 1995). On the other hand, if the environment is degraded faster than it can restore itself, community well-being is affected, increasing the risk of poverty, human suffering and instances of social injustice (Pezzoli 1997, Berkes and Folke 1998, King and Hood 1999, Ostry 1999). The level of resource-extraction is thus a crucial element determining social well-being (Adger 2000).

Maintaining a healthy balance between human prosperity and environmental integrity is at the core of the principles of Ecological Sustainable Development and of natural resource management practice (Dasgupta and Maler 2001, Carpenter and Brock 2004, Hughes et al. 2005). Consequently, resource policies are introduced to regulate the extent to which natural resources are extracted. However, in the same way that a degraded resource can affect social well-being, institutional rules and regulations can alter the relationship between resource-users and a resource (Boserup 1981, Burdge and Vanclay 1996, Farmer and Albrecht 1998). Policy changes often require resource-users to change their level of access to a resource, their level of harvest or the methods by which they harvest. The consequences of such changes, however, can be unexpected and undesirable. For example, a policy change that banned net-fishing in Florida inadvertently resulted in significant declines in human welfare and standards of living (Smith 1995, Salz 1998, Adams 2000, Smith et al. 2003).

Resource managers urgently require prior knowledge of the likely social consequences of their management actions if they are to prevent declines in social well-being. Predicting the social consequences of management actions requires a certain knowledge of the relationship that people have with a resource (Canan and Hennessey 1983, Albrecht and Thompson 1988, King 1998). However, there are no ready guidelines to study the nature of the interactions between social and ecological systems (Levin 1998, Berkes and Folke 2000). The relationship is difficult to study because it is dynamic, complex and variable (Berkes and Folke 2000, Folke et al. 2002a, b, Gunderson 2004). Any outcomes from predictive models are likely to change both quantitatively and qualitatively as the systems evolve together. The relationship is thus often described empirically, rather than using a theoretical rationale (Vanclay 2002).

The relationship between resource-users and a resource has been described in terms of economic, social and environmental (e.g. physical and biological, ecological) factors. Within a fisheries context, for example, physical factors such as the distance from shore that a fisher might travel, the depth of water that they might operate in, the amount of time spent fishing, descriptors of the range of weather conditions and currents that they might experience, and proximity to transportation networks and surrounding population centres have been used to describe the relationship (Krannich and Zollinger 1997, Wingard 2000). Biological factors have described whether a fisher nets for fish or crabs, targets pelagic species or trawls for prawns. Ecological factors compare the differences between resource systems (Machlis et al. 1990, Randall and Ironside 1996). The time spent fishing, the risks associated with personal safety at being at sea, the unpredictability of resource availability, dependency on the weather, and the level of skills at catching fish are other descriptors of the relationship between fishers and the fisheries resource (Poggie and Gersuny 1974, Carroll and Lee 1990, Cinner 2005). These factors, however, do little to provide insight into the likely social consequences of altering the relationship.

Common property-based resource (CPR) management is an important and well-developed theoretical concept that seeks to describe the relationship between resource-users and a resource in order to identify more effective methods to manage natural resources. Common property regimes are a way of privatizing the rights to access a resource without dividing it into pieces (Hardin 1968, Agrawal 2001). Historically, common property regimes have evolved in places where the demand on a resource is too great to tolerate open access. The main focus of CPR management literature is to specify the conditions under which resource-users will self-organise and sustainably govern resources upon which they depend. If human beings depend on extracting as much out of a resource system as the system can sustainably offer, then a good understanding and careful fine-tuning of their resource use becomes essential (Baland and Platteau 1999, Dolsak and Ostrom 2003). Common property regimes are essentially a way to institutionalize and arrange this kind of fine-tuning when resource systems are pushed to their limits.

In one of the few comprehensive reviews of the relationship between people and the environment, Hodge (Hodge 1997) attempted to identify a model or approach describing the relationship that would be suitable for addressing the challenge of socio-ecological

sustainability. He focused on published studies that were based on ideas that are consistent with those of complex adaptive systems. The 29 conceptual models that he reviewed ranged from a systems analysis to a cellular-level study of the 'stress on people from natural events'. Specifically, among the models were 11 "social-economic-environmental" models, 3 economic models, 3 stress and stress-response models, 2 general ecological models, 4 models from the sustainable development literature, 1 by the AGENDA 21 macrostructure and five miscellaneous models (comprising a regional analysis, a watershed analysis, carrying capacity, aboriginal development and quality of life). Hodge (1997) concluded that none of the models were satisfactory in meeting the requirements of managing for sustainability, although collectively they have significantly progressed our understanding of the relationship. He suggests that the greatest insight to emerge from these models is the need for data and information within four main domains; ecosystem, interaction, people and synthesis. This study addresses the 'people' domain.

Resource dependency is a concept used to describe the nature and strength of the relationship that people have with the environment that they depend upon for income and everyday living (Force et al. 1993, Bailey and Pomeroy 1996, Krannich and Zollinger 1997). Communities that are predominately farming, mining, fishing or logging communities are typical examples of resource-dependent communities (Bailey and Pomeroy 1996, Jacob et al. 2001). The ability of resource-dependent people to be resilient to changes in resource policy might be successfully predicted with some knowledge of why and how people are dependent on a resource. Such knowledge may also assist in the development of strategies to reduce the level of dependency on the resource and increase the ability of resource-users to respond resiliently to change in resource policy designed to ensure resource sustainability. As Machlis and Force (1988) point out, "how communities dependent on natural resources react to change in their resource base has local and national policy implications, and is central to issues of international development, rural development and social change". A conceptual understanding of resource dependency is a precursor to measuring the level of dependency on a resource and testing its influence on social resilience. The purpose of this chapter is thus to develop a conceptual understanding of resource dependency that can be easily operationalised.

3.2 Historical descriptors of the relationship with the environment

Historically, the relationship that resource-dependent people have with the resource has been described mostly in economic terms (Nord 1994, Beckley 1995, Overdevest and Green 1995, Stedman 1999). For instance in some studies, dependency has been measured as the economic value of the resource, resource production levels, the percentage of direct and indirect industry sales or as the percentage of the labour force directly employed by the resource industry (Brookshire and D'Arge 1980). More sophisticated measures such as industrial specialisation, community total income, level of exports, pace of technological change and occupational structures and extractive economic growth are also used (Cook 1995).

Randall and Ironside (1996) conceptualise resource-dependent communities using the 'labour-segmentation theory' approach, for example, where the core segment of the labour market is male and the secondary segment is female and minorities. Other researchers have looked at the return on capital investment in resource-dependent communities, and how various sectors within or outside of the community compare and contrast. For instance, Overdevest and Green (1995) describe resource dependency using the concept of extractive economic growth. One of their ideas uses the theory of incremental growth by which profits are reinvested into the community for public services in order to develop the community into a self-sustaining and diverse economy. Individual development does not occur at the site of extraction, but rather in cities with an established infrastructure and an abundance of low-wage workers. Machlis et al. (1990) describe resource-dependent communities as small towns existing in mass economies. They describe communities as embedded in larger systems that are complex and varied. They see this view as putting more emphasis on the role of socio-cultural change at regional and national scales where social measurements of change at the local level are likely to be proxies for actual causes at larger scales. Humphrey (Humphrey 1994) suggested that there is an unequal exchange of capital and other resources between resource-dependent areas and urban areas, where urban areas rather than rural areas are the main beneficiaries of a resource since they are more likely to receive profits from resource extraction. Stedman (Stedman 1999) similarly found that profits made from a resource are not always reinvested back into the community, but are shunted elsewhere such that, even when production levels are high, and employment levels are high, poverty rates can still be increasing within the local community because of ongoing outside structural factors. As a result, an economically valuable resource

does not necessarily mean that the local community will be well-off (Humphrey 1994, Stedman 1999).

Although economic descriptors of the dependency that people have on a resource are crucial in understanding the nature of the relationship, economic descriptors do not provide a full description of the complex and dynamic relationship that humans have with the environment (Kates et al. 2000, Higgins and Lockie 2002). Economic well-being does not always translate into social well-being (Beckley 1995). Focusing on economic measures of resource dependency, alone, misses the richness and complexity of the relationship (Freudenberg 1992, Flora and Flora 1993, Reed 1999), and thus the true spectrum of social consequences of altering the relationship may be overlooked (Parkins 1999).

3.3 The social nature of the relationship with the resource

People are fundamentally influenced by the social relationship that they have with the environment (Proshanksy et al. 1976, Jones and Dunlap 1992). In fact, Proshanksy et al. (1976) believe that, "indeed, the social effect of the environment we ourselves have created may prove to be the most important aspect of this relationship." Once, the resource was perceived as existing primarily to serve human needs (Stedman 1999). As resources became obviously degraded, an ecological consciousness developed and concerns of ecological sustainability became an important aspect of the relationship (Buttel 1987). Humans were then regarded as a barrier to sustaining a resource's ecological integrity where it was believed that humans acted 'outside' of the natural processes. More recently, humans are regarded as being vitally linked to resource systems and the relationship is now regarded for its capacity to sustain healthy human populations (Rapport et al. 1998).

The social relationship between people and the environment is complex. While it is often evident that changes in resource production levels are associated with changes in society, the range of changes are not always predictable, and the proximal causes of the changes are not always clear (Vanclay 2002). For example, Machlis et al. (1990) found that even though marriage rates rose when timber and mining production levels increased in two resource-dependent communities in the USA, they also found that crime rates increased. Some studies have shown that an increase in resource supply in a community can provide a positive influence on community stability (Beckley 1995), whereas other studies have shown that it does not (Krannich and Greider 1984, Greider and Krannich 1985, Greider and Little 1988).

Force et al. (1993) collected historical data on natural resource production levels and social change, and analysed the relationship between them through a series of regression models. They found that the major influences on community well-being included the business cycle, interest rates and the relation between capital and labour (e.g. automation), whereas other researchers asking similar questions found that the quality of employment, social cohesion and local empowerment were important factors (Nord 1994, Beckley 1995, Stedmann 1999).

3.4 Characterising dependency on the resource

The number of studies that have been conducted within resource-dependent communities around the world is vast. The body of work on resource dependency clearly shows that the relationship is complex, variable and highly context-specific. Nonetheless, common components of the relationship can be identified to describe the nature of the relationship between people and the resource in a way that is beneficial for addressing the challenge of socio-ecological resilience. In this section, I introduce key social, economic and environmental attributes that best describe the relationship for the purposes of the study. These variables are chosen on the basis that they may provide insight into why and how people are dependent on the resource and what the consequences of altering the relationship might be.

3.4.1 Social factors

People working and living in resource-dependent communities can be dependent upon a natural resource because of many social associations and factors. People can be excessively attached to their resource-extractive occupation; they may lack other skills and attributes to gain employment elsewhere, they may be especially attached to living in their community, or may lack the flexibility to take advantage of other opportunities because of family circumstances. Each of these attributes is described in turn. Attempts are made to show how these attributes might significantly influence a resource-user's ability to be resilient to changes in resource policy.

3.4.1.1 Attachment to the occupation

Resource-users can become especially attached to their occupation. People form occupational communities if they are members of the same occupation, have some sort of common life

together and are, to some extent, separate from the rest of society (Gerstl 1961, Salaman 1974). Members of occupational communities are affected by their work in such a way that their work relationships, interests and values permeate their non-working lives (Hughes 1958). They build their lives around their work; their friends are from the same occupation, and their leisure interests and activities are work-oriented (Becker and Carper 1956). A person's self-image is based on a set of attitudes, beliefs and opinions held about themselves, and they depend on the support, encouragement, recognition and acceptance of others (from the same occupation) for their stability (Becker and Carper 1956, Salaman 1974). The more firmly attached a person becomes to their occupation, the more traumatic and disorienting a change in occupation is likely to be (Twigger-Ross and Uzzell 1996). When a person with a strong occupational attachment is suddenly faced with the prospect that they are no longer able to continue in their current occupation, they not only lose a means of earning an income, they lose an important part of their self-identity.

The self-identity that is created as a result of working in a resource-extractive industry can be described using four principle components: distinctiveness, continuity, self-esteem and self-efficacy, each of which is important to maintain at a favourable level (Pajak 2000). 'Distinctiveness' enables people to differentiate themselves from other people. It describes a lifestyle and acknowledges that people have a specific type of relationship with their environment or occupation, which is clearly different from any other type of relationship. Fishing for example is a unique category of work, in which fishers quickly develop a sense of 'distinctiveness' (Tunstall 1969, Salaman 1974).

'Continuity' is an important component of identity which allows for the maintenance or reinforcement of identity (Twigger-Ross and Uzzell 1996). Choosing to change occupation or place can represent a 'self-concept' change with an 'old' self being replaced by a 'new' self. There is strong evidence to suggest that control over whether this change occurs is important for psychological and emotional well-being (Fried 2000). Unwanted and uncontrollable change resulting in the loss of continuity may cause grief and a strong sense of loss. After the recent British foot and mouth epidemic, for example, farmers were desperate to return to what they knew as normality and intended to restock. Many farmers felt deeply committed to continuing in farming (Bennett et al. 2002). This information can assist with predicting the likely consequences of altering the nature of the relationship for people with a strong attachment to the occupation.

'Self-esteem' enables people to positively evaluate themselves. It is closely related to a person's feeling of worth or social value, and is associated with a sense of pride (Twigger-Ross and Uzzell 1996). Tracey (1995), in her analysis of family firms in the New South Wales logging industry, found that loss of pride was a significant impact on logging contractors. In the words of the loggers, "I used to say I was a logging contractor with pride, now I say it with a little caution" (Tracey 1995). In a Canadian town, Port Alberni, over half of the timber workers (2,600) were put off as a result of a massive restructure in the industry (Barnes et al. 1999). Many loggers expressed the job-loss as a blow to their self-esteem. People who had lost their jobs made comments such as: "it gave me a total sense of helplessness" and, "it was the worst time in my life". One of the wives of the laid-off workers said, "you can't imagine the desperate feelings, the helplessness, the anxiety of each day . . . you start to wonder if the hell-hole of a town, or jobs you try to get is worth all the disappointments. You wonder how on earth you can keep going, trying to be in a somewhat decent frame of mind, if not for yourself, then for your kids" (Barnes et al. 1999).

'Self-efficacy', the fourth component of self-identity, is defined as a person's belief in their capabilities to meet situational demands or tasks (Twigger-Ross and Uzzell 1996). This is increasingly regarded as being important for psychological well-being. Tracey (1995) in her study of the logging industry in New South Wales found that the erosion of status in the community combined with the uncertainty over the future of livelihoods put significant stress on logging families. This was especially true for those who had large debts and where the family home was used for collateral on bank loans. Many were suffering from stress-related health problems and were on medication such as anti-depressants and sleeping pills, while others drank alcohol more heavily than before. Other symptoms of stress included increased frequency of arguments among many couples (Tracey 1995).

Carroll and Lee (1990) provide an excellent example of how these components can combine to develop an occupational identity and to heighten the level of dependency upon a resource. Carroll and Lee (1990) studied loggers faced with changing economic conditions in Canada. They describe the logging industry as an occupational community where logging was more than a means to provide wages; it was a way of life with highly developed traditions and shared values. They described the identity of loggers in terms of independence, pride in skills, pride in facing danger, and a sense of being in a unique category of workers. These descriptors are related to the components of self-identity described above. Loggers told the researchers stories about their accomplishments that demonstrated their superior skill, physical strength

and 'unblinking nerve' that set them apart from 'ordinary people'. They had shared meanings, also. For instance, loggers saw each other as extreme, rugged individuals whose survival and prosperity depended on their initiative, skill and hard work. Common sense was highly valued. Job security with particular employers was not important in the study area, since logging 'crews' would be put together each year depending on how hard each person worked (Carroll and Lee 1990).

Fishers also form occupational communities (Tunstall 1969, Salaman 1974). Fishers have been described as possessing three characteristics that underlie their identity and sense of community: a self-image centred on their occupational role; a reference group shared with other fishers; and an association with other fishers in preference to non-fishers (Tunstall 1969, Salaman 1974). These characteristics are also related to the components of self-identity described above. Tunstall (1969) describes (trawler) fishers in Britain as being deeply influenced by their work, as evidenced by their attitudes, language, beliefs and activities. He found that these fishers belonged to a traditional working class community and took pride in doing 'men's work'. Fishing is a particularly dangerous job: it is especially uncomfortable, depriving, arduous and physically demanding (Tunstall 1969). Although the pay may be substantial over the year, on an hourly basis their pay rate is in the lower end of the range for adult male workers in Britain. Despite, or perhaps because of, the hardships, fishing has enormous emotional significance for those involved (Tunstall 1969). Whilst on shore, the main form of relaxation for fishermen was drinking with other fishermen, because '…only they [other fishers] are free all day when ashore, have the same attitude to life, and the same spare cash' (Tunstall 1969).

These examples demonstrate how people working in resource-extraction industries can develop a strong attachment to the resource-occupation and associated lifestyle and become dependent upon continuing within their occupation. Psychological impacts are, otherwise, likely to manifest (Smith et al. 2003). Alternative livelihoods are unlikely to be considered (Poggie and Gersuny 1974). The attachment that resource-users have to their occupation may thus be an important predictor of how they might respond to a new policy and adapt.

3.4.1.2 Employability: Age, education and attitude to working elsewhere

Resource-users can become dependent upon a resource because they lack certain skills and attributes that allow them to take advantage of other employment opportunities within the

region. A person's age, attitude to working elsewhere and level of education can be an indicator of their level of employability (Rickson et al. 1990b, Barnes et al. 1999, King and Hood 1999, Allison and Hobbs 2004). People living and working in resource-dependent communities generally have few transferable skills and become 'locked' into their occupation as a result (Humphrey 1994, Reed 1999). This is because people living in resource-dependent communities are often determined to follow career goals in their chosen areas and leave the education system early, securing apprenticeships and taking advantage of their age and economic employability (Marsh and Williamson 2001). The relatively low educational requirement for entry into an extractive industry means that people can still obtain a job that is well paid. In the short term the benefits are high. If jobs become scarce within the industry, however, then these people are severely disadvantaged in the employment market and become especially dependent on maintaining their resource-extractive occupation (Rickson et al. 1990a, Freudenberg 1992, Marsh and Williamson 2001).

People who face the prospect of unemployment at an older age can be especially challenged by change because they often lack transferable skills and interest in beginning a new career (Allison and Hobbs 1994, Barnes et al. 1999). This group of resource-users are, "too young to retire and too bloody old to work" (Barnes et al. 1999 page 781). A study from the disbanding timber industry in Queensland also found that older workers were the least willing to relocate and begin a new career (Rickson 1991). Older workers affected by massive cutbacks were also generally least equipped with the occupational and social skills necessary to take advantage of new employment opportunities in tourism that were expected to be created (Rickson et al. 1990a).

A person's ability to earn an income outside of their industry is also influenced by the number of employment opportunities that exist within a community. Many resource-dependent communities are physically, socially, and economically isolated from major regional centres, and opportunities in the form of alternative employment are typically limited (Marsh and Williamson 1991, Bailey and Pomeroy 1996). Reed (1999) describes a situation in Oregon where "prosperity still eludes many of our distressed rural communities . . .too many Oregonians don't qualify for all the new, well paying jobs created because they lack sufficient education and work skills" (page 381). Remote communities are less likely to attract and retain a diversity of industries and they have less access to labour markets (Illo and Polo 1990). The consequences of implementing change within a community with limited alternative employment opportunities can be so devastating that suicide rates can be affected (Humphrey

1994, Nord 1994, Peluso et al. 1994, Humphrey 1995). In the early 1980s, for example, a restructure removed 40% of the workforce in a forestry town in Canada (Ostry 1999). The job losses had most impact upon the young workers and those near retirement, and even those who were able to secure alternative jobs suffered a reduction in wages. By 1995 the suicide rate for males in this town had increased by a factor of eleven; a trend attributed to the lack of employment opportunities within the town (Ostry 1999).

An important consequence of change within communities with limited opportunities is the development of 'resource-addictive communities' (Freudenberg 1992). Freudenberg (1992) describes how a resource-dependent community can be very prosperous at the outset. Over time, profits decrease as the resource becomes more difficult to access, or less valuable. Resource-users believe that if they were to remain within the industry for a little longer, then the 'good times' might return. Communities that are dependent upon a resource that no longer offers profits are described as an 'addictive community' (page 305) (Freudenberg 1992). Local communities may have not correctly read or adjusted to market signals and the community may become more dependent on the resource (Freudenberg 1992). People in such communities show no inclination to look for income elsewhere and show similarities with drug dependency: the initial experience may be pleasurable, yet the long-term consequences can become debilitating (Freudenberg 1992, Frickel and Freudenberg 1996).

These examples demonstrate how low level employability, combined with a limited number of alternative employment opportunities, can exacerbate the level of dependency on a resource. Resource-users in these situations may exhibit symptoms of 'resource-addiction' where they show little inclination to improve their current situation. The level of employability of resource-users may thus be an important predictor of how they might respond to a new policy and adapt.

3.4.1.3 Attachment to place

The level of attachment that a resource-dependent person has to their community may be an indicator of their willingness and ability to search for employment elsewhere or to diversify locally (Fried 2000, Adger 2002). 'Attachment to place' is a concept that describes the level of connection that individuals have with their physical community (Twigger-Ross and Uzzell 1996, Green 1999, Hidalgo and Hernandez 2001). It allows us to understand comments such as, 'this is a timber town' where an identity is created around the township, a sense of pride is

associated with belonging to the town, and strong friendships and networks exist within it (Flora 1998). The concept provides insight into social well-being and quality of life, and is a useful indicator of community sustainability (Mitchell 1974). Attachment to place develops to different degrees within different spatial ranges and temporal dimensions. Generally, social attachment within a community is greater than physical attachment to the community, and the degree of attachment varies with age, gender and length of residence (Hidalgo and Hernandez 2001). Women show greater place attachment than men and attachment to place increases with age. No differences have been found in attachment regarding social class (Hidalgo and Hernandez 2001).

The attachment that resource-users have to their community may be an important predictor of how they might respond to a new policy and adapt. For example, resource-users with a strong attachment to their community are often unwilling to migrate in order to maintain their income levels because they are reluctant to leave behind their economic and emotional support groups and adapt to a new community (Field and Burch 1988). People with a strong level of attachment can be significantly distressed at the prospect of moving from their town or place (Locke et al. 2000). In the Philippines, for example, fishers who are no longer able to sustain an income from their community need to borrow money from older family members in order to migrate from a community in the search for better opportunities elsewhere (Illo and Polo 1990). In addition to economic concerns, fishers that need to fish at night time or in the early morning have increased worries about the safety of their wives and families in the new village, since they are without the support of family and established friendships. Women are further often required to take on employment in the new village because of the extra debt associated with the relocation. This is especially difficult for couples with children since they no longer have the support of family and long-time friends (Illo and Polo 1990). These circumstances can act as strong incentives to remain within the same community.

People will often prefer the stability associated with remaining in the one community, and this can increase their dependency on the nearby resource (Fried 1963, Stedmann 1999). Carroll et al. (2000) looked at the adaptive strategies of displaced Idaho timber employees shortly after they were laid off and then again a year later. Of the 84 respondents involved in the research, only 2 had left their home area in search of employment opportunities, despite there being no increase in the prospects of employment, suggesting that place attachment was a significant factor. Hence, although migration to new places for work can contribute to social resilience by assisting in the adaptation process, migration can also diminish resilience by increasing

financial and emotional stress and weakening social structures (Fried 1963, Field and Birch 1988, Force et al. 1995, Fried 2000).

3.4.1.4 Family characteristics

Whether a resource-user has a family can be an important measure of how dependent they might be on a resource. People with families are less able to experiment with their options for the future, and are consequently less flexible in their approach to change (Sorenson and Kaye 1999, Bennett 2001). The level of emotional and financial stress within families can determine the rate at which 'thresholds of coping' are reached (Machlis and Force 1988, Berkes and Folke 1998, Holling et al. 1998). In extreme examples, a family that has reached their threshold may face breakdown or divorce (Zvonkovic et al. 1997). Smith (1999), for example, showed that after the Florida net ban, divorce rates for the commercial fishing industry in the USA were four times the state average. These results indicate that fishing families in Florida were highly dependent on the resource.

Faced with the prospect of a change in the relationship with the resource, resource-users must consider the impact of the change upon their families. Resource-users with families are more vulnerable to changes in the relationship. For example, in a study of the social implications of fisheries policy change in Florida (the Florida net ban), Smith (1995) found that 45% of women were required to increase their time in non-fishing employment either by starting work or by adding hours to their current job. This reduced financial strain within the household but increased marital stress since the women still had to do all of the normal chores. In addition, Smith (1995) found that women were more aware of the financial situation that was being created since they normally kept the financial records, and were most often confronted with the 'bottom line'. Women frequently shielded men from this extra stress, and in this way also acted as emotional buffers. Smith (1995) further found that men's confidence in their ability to fulfil a traditional 'breadwinner' role was also shaken as a result of the net ban.

Not all families within resource-dependent communities require equal consideration or render resource-users equally dependent upon the resource. Poggie and Gersuny (1974), for instance, compared fishers' wives with mill-workers' wives, and found that fishers' wives were more supportive of their husbands and more appreciative of the material and personal rewards of their husband's work, suggesting that the influence of a family may be different between fishers and mill-workers. Furthermore, families can be sources of support during transitional

times. In the farming industry, for example, Bennett (2001) found that the support of wives had important consequences for how a family responds to rural restructuring. In studies outside the natural resource context, the support of wives has also been shown to be important for success within small family businesses (Sorenson and Kaye 1999).

These examples demonstrate that the characteristics and circumstances of having a family may influence the level of dependency on the resource. Resource-users with families may be limited in their approach to changes affecting their relationship with the resource on one hand, but on the other hand, resource-users with families may be emotionally better supported by having a family. Hence, the presence and characteristics of a family may be an important predictor of how they might respond to a new policy and adapt.

3.4.2 Economic factors

Economic factors are important in describing the level of dependency that resource-users have on a resource. The level of financial investment (business size) into a resource-extractive industry, the degree to which lifestyle benefits as opposed to profit margins motivate the running of the business (business approach) and the level of poverty or financial security (financial status) are three means by which economic dependency on the resource can be described. Each is introduced in turn with specific reference to how they might influence a resource-user's ability to be resilient to changes in resource policy.

3.4.2.1 Business size and approach

The business size and approach that resource-users adopt can influence their level of dependency on the resource and how they might respond to changes in their relationship with the resource. Business size and approach are potential indicators of the business skills that people possess, of their competitive advantage within the resource industry and their level of transferable skills outside of the resource industry (Humphrey 1994, Nord 1994, Peluso et al. 1994, Abel and Langston 2001). In agricultural areas, for example, property size is a key determinant of adaptive capacity (Abel and Langston 2001). Larger businesses can buffer themselves from unpredictable problems such as mechanical breakdowns, difficult employees and fluctuations in the weather. They can take bigger risks and experiment with their options for the future (Stedman 1999, Abel and Langston 2001). In addition, business-owners in larger companies are more likely to have the ability to motivate, plan, organise and act and are more

likely to be driven by economic incentives to harvest the resource (Stedman 1999). The most successful fishers in terms of income are those that are more competitive in a business-sense and are better at exploiting the resource (Poggie and Gersuny 1974, Gramling and Freudenberg 1992).

Small-scale operators, in contrast, are more likely to be driven by 'lifestyle' incentives and may not possess the necessary skills to be competitive within the industry in the event of a change in the resource relationship (e.g. Humphrey 1994, Nord 1994, Peluso et al. 1994). Smaller-scale operators are less competitive and less able to sustain income for themselves and their crew. Since these smaller operators lack the opportunities to better their income, they remain especially dependent upon the resource (Gramling and Freudenberg 1992, Nord 1994, Peluso et al. 1994, Abel and Langston 2001).

3.4.2.2 Financial status

The financial status of a resource-user, defined by their level of income and level of debt, can significantly influence their level of dependency upon a resource (Johnson and Stallman 1994, Overdevest and Green 1995, Allison and Ellis 2001, Fisher 2001). Change affecting the relationship with the resource is nearly always costly (Ogburn 1972, Chambers 1989), and resource-users with a lower financial status lack the flexibility with which to successfully approach change (Humphrey 1994, Nord 1994, Peluso et al. 1994, Fisher 2001). Tracey (1995) described how changes within the logging industry in New South Wales put an extraordinary amount of pressure on logging families with low financial status because it removed their ability to respond effectively to the changing conditions within the industry. Borrowing money, and investing in better resource-extracting technology for example, can increase financial status; however this makes for a vulnerable situation (Chambers 1989). People with a low income are often reluctant to take on these further risks (Ogburn 1972, Chambers 1989). Field and Burch (1988) illustrate how poor peasants in Asia are more likely to try new varieties of rice rather than new tree species, since rice grows relatively quickly. If a new rice crop fails, the loss is not as great as had a tree crop failed. As such, people with lower incomes are less likely to experiment with their options for the future and have less flexibility with which to approach change.

Poor financial status can also affect the rate at which resource-users reach their threshold of coping. In Port Alberni, Canada, Barnes et al. (1999) looked at the repercussions of a massive

lay-off of workers in the timber industry, where some 40% of the mortgages at one bank were repossessed in the first 6 months. Many home-owners simply left and forfeited their equity. Similarly, increased poverty was one of the main consequences of a massive restructuring of the timber industry in western Washington in which 25% of the workforce was removed (Humphrey 1995). Smith (1995), in looking at the social implications of changes in fisheries regulations in Florida, found that the impacts mostly related to financial strain, where most families reported a substantial decrease in income from fishing. Specifically, she found that 33% had decreased their health insurance and health care and 99% had their income affected. Some 45% of wives started work elsewhere. These examples illustrate how a change in the resource relationship can affect resource-users with low financial status by sending them further into financial decline and closer to their thresholds of coping.

Low financial status is typical of resource-dependent communities around the world. Bliss et al. (1998) describe the hundreds of communities in the rural south of the USA, where, despite having rich natural resources surrounding them, the financial status of community members is especially low. Within Asia, poverty is closely associated with resource dependency and attributed to increases in population numbers. In Indonesia, the population increased by 77% between 1979 and 1990. In 1979 there were 2 million fishers, and by 1989 there had been a 30% increase to 2.6 million fishers (Bailey and Pomeroy 1996). Within Australia, the level of poverty in resource-dependent regions may not be as pronounced as in resource-dependent communities elsewhere in the world. However, Fenton and Marshall (2001a) have shown that 54% of all fishers in Queensland earn less than AUS$26,000 a year; a considerably small amount.

These examples demonstrate how people of a low financial status are unlikely to be able to adapt to a change in their relationship with the resource, since such a change is likely to incur financial costs (Ogburn 1972, Chambers 1989). A change in the relationship with the resource is also likely to result in further poverty where the thresholds of coping will be reached more quickly. The financial status of resource-users may thus be an important predictor of how they might respond to a new policy and adapt.

3.4.3 Environmental factors

Environmental factors are only rarely used to describe the level of dependency that resource-users have on the resource. Nonetheless, there are some important descriptors of the

relationship that can exacerbate the dependency that people have on the resource and can potentially influence their ability to be resilient to changes in resource policy affecting their relationship. These descriptors include the level of specialisation and the development of local knowledge and harvesting skill as indicated by the time spent harvesting. Each is introduced here with specific reference to how they might influence a resource-user's ability to be resilient to changes in resource policy.

3.4.3.1 The level of specialisation

The level of specialisation of resource-users can influence their level of dependency upon the resource (Machlis and Force 1988, Bene and Tewfik 2002). Specialisation within industries such as the fishing industry occurs as the result of capital being secured in vessels and equipment (Nord 1994). This increases the efficiency of the operation, decreases the price of the product and maintains social status (Poggie and Gersuny 1974). Resource-users that target only a few species, or are reliant on a single resource are severely restrained in their ability to be flexible and adapt to changes in the resource relationship. They are vulnerable to resource degradation or being denied access to the resource and are dependent on the seasons bringing good harvests (Field and Burch 1988, Bailey and Pomeroy 1996, Adger 2000). Such people are severely constrained in their ability to adapt to change and function 'normally' (Machlis and Force 1988, Stedmann 1999, Adger 2000). This is especially true of fishing communities around the world (Field and Burch 1988). However, this has not always been the case for resource-dependent people. In the past, with the onset of winter, farmers for instance "put aside their ploughs and took to the woods," in order to increase their flexibility and survive the changing seasons (Beckley and Reimer 1999).

Specialist behaviour is typical of regions in which resources are predictable and the system is regarded as 'stable'. However, the 'stable' system is not necessarily resilient in the face of change. Thus, in areas where resources are less predictable, a 'generalist' strategy is mostly evident. Generalists or resource-users that target more than one species can exhibit a more 'resilient' nature since they can interchange between resource types as the need arise. For example, fishing households in Southeast Asia generally have broad sources of income and are well adapted to fluctuations in the marine and social environment (Bailey and Pomeroy 1996).

The level of specialisation may be a good predictor of the level of dependency on the resource, since it describes the ability of resource-users to access alternative income sources in the event of a change in the resource relationship.

3.4.3.2 The time spent harvesting (skills and local knowledge)

The time spent in harvesting a resource may also be a good descriptor of the level of dependency on a resource, since it reflects the amount of personal investment within the resource-extractive industry and the development of skills and knowledge (Carroll and Lee 1990, Gadgil et al. 2004, Cinner 2005). These factors are a measure of the level of human capital that has been developed (Coleman 1988, Wingard 2000). Human capital is the knowledge, skills, abilities and values that individuals develop (Fenton and Carr 2001). It can be obtained through learning and direct experience, and can be used to increase economic capital (increasing profitability and income) through the application of knowledge, skills and abilities for economic return. It can also be developed through social capital - using networks and normative processes of mutual obligation in which exchange is non-economic (King and Hood 1999, Fenton and Carr 2001). The time spent harvesting a resource may be a measure of the current allocation of time harvesting a resource, as well as a measure of the number of years within the resource-extractive industry. However, little research has been conducted that explores the role of human capital in influencing resource dependency, and how human capital might influence social resilience (Wingard 2000). It may be a factor that is highly correlated with 'attachment to the occupation'. Nonetheless, people that spend more time harvesting the resource are expected to be more dependent on the resource than people that have additional income or have only recently entered the industry.

3.5 A conceptual model of the influence of resource dependency on resilience

A review of the resource-dependency literature suggests that there is a lack of an encompassing and coherent definition for resource dependency that can be used in addressing the challenge of socio-ecological sustainability. Yet, a broad definition of the concept is required in order to guide future theoretical and applied research and in order to assess its significance in influencing social resilience.

This chapter has revealed that many social, economic and environmental elements of resource dependency can influence the social outcomes associated with changing the human-resource relationship. Importantly, the social context within which individuals exist, and specifically the range of alternative employment opportunities that exist, also influences the level of dependency upon a resource.

Figures 3.1 and 3.2 provide a summary of the results from this chapter. Figure 3.1 presents the key characteristics of resource-users that influence their level of dependency on the resource and describes their relationship with the resource. It suggests that some people can be more dependent than others because of a range of economic, social and environmental factors. Because the elements within the model can be measured relatively easily, the conceptual model provides a basis for an operational understanding of resource-dependency. Figure 3.2 illustrates how a change in resource policy that affects the relationship between resource-users and the resource might produce social outcomes that pertain specifically to the nature of the dependency and can ultimately influence their ability to be resilient. For example, a review of the literature has suggested that the level of attachment to the resource-extractive occupation is interlinked with the concept of self-identity. A change, such as a resource-policy change, that interrupts this relationship is likely to result in psychological impacts relating to 'identity-crises'. In turn, such impacts are likely to render resource-users less likely to cope and adapt to policy change and be resilient.

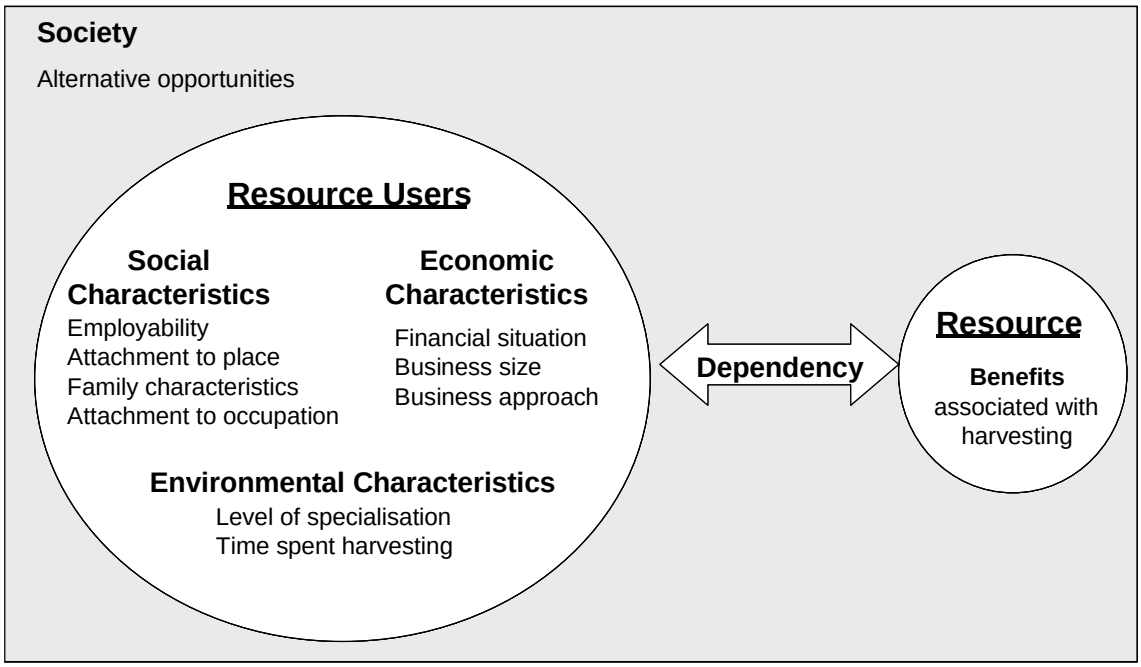


Figure 3.1. The key characteristics of resource-users that influence their dependency on the resource

This simple conceptual model (figure 3.2) builds on emerging theory about resource dependency, and provides a framework for refining our understanding of how people are dependent on a resource. It explores the practical implications of altering the relationship, and how their resilience to change might be affected. It also suggests that resource-dependency may be a significant influence on social resilience. The model developed and its utility in guiding policy development processes are tested and explored in chapter 8 using the commercial fishing industry in North Queensland.

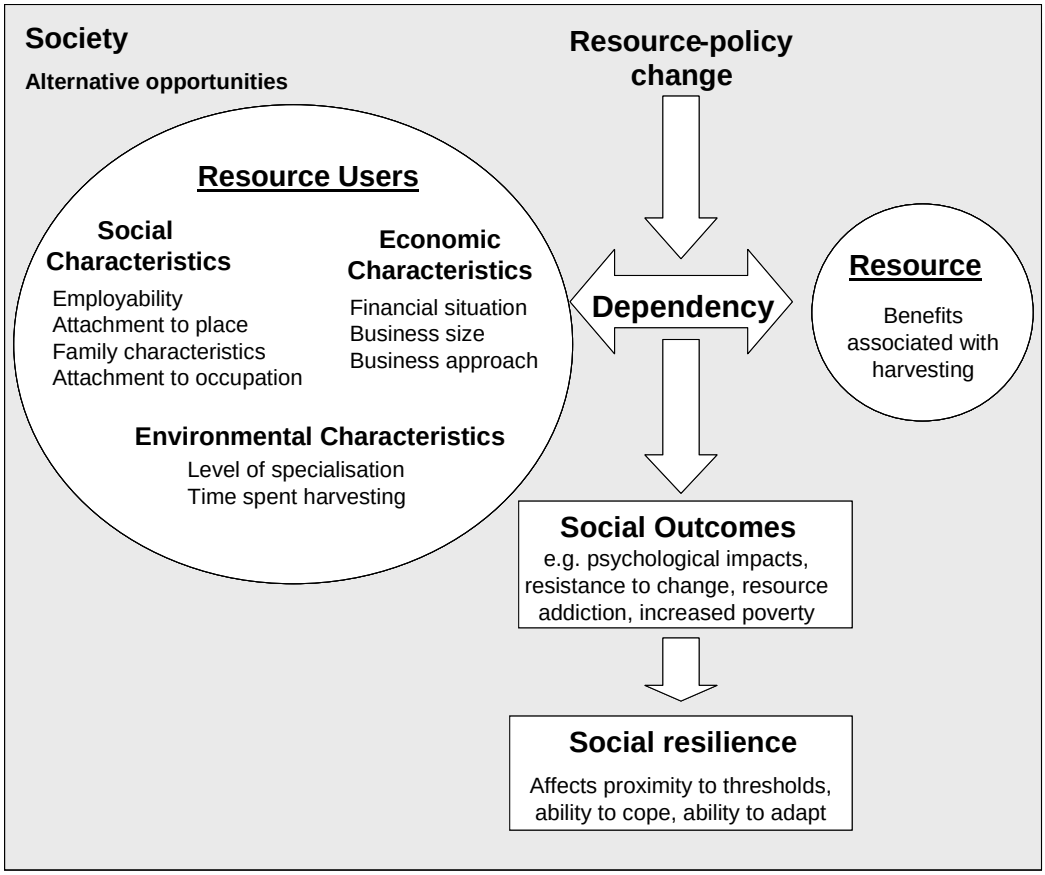


Figure 3.2. The key characteristics of resource-users that influence their dependency on the resource and their likely resilience to resource-policy change

Chapter 4.
The Influence of Institutional Change on Social Resilience

4

Alice came to the fork in the road.
"Which road do I take?" she asked.
"Where do you want to go?" responded the Cheshire cat.
"I don't know," Alice answered.
"Then," said the cat, "it doesn't matter."
- Lewis Carroll, Alice in Wonderland

4.1 Introduction

Institutions are fundamental building blocks of societies that provide the guidance or regulatory framework for socially acceptable behaviour (Wiber 2000, Connor and Dovers 2002). They can be formal – where they are administered through legal frameworks and government departments (Scoones 1999, Haller 2002) - or informal, such as norms of behaviour, conventions and self-imposed codes of conduct (North 1990a, Scoones 1999, Connor and Dovers 2002, Fenton 2004). Within a natural resource management context, formal institutions encompass the rules and regulations that determine who can access the resource, to what extent, when, where, how and under what conditions (Scoones 1999, Haller 2002). Formal institutions, or government regulations, are the focus of interest of this study.

Institutions are vitally important tools in the management of natural resources (Folke et al. 1994, Andrews 1996, Mathieu and Trottier 2002, Armitage 2005). Institutions determine how natural resources are managed and determine how the benefits of resource production will be distributed within a community (North 1990a). Without strong institutions, the management of many natural resources is unlikely to be effective (Andrews 1996, Kaczynski and Looney 2000). In order to ensure that institutions maintain their effectiveness in achieving resource sustainability, institutions that have become redundant or are perceived to no longer effectively achieve the desired outcome are replaced by new ones. Because environmental

degradation is occurring at such a rapid rate in many regions, institutions are frequently replaced in order to meet the goals of sustainable development (Ostrom 1999, Sydnes 2001, Brunckhorst 2002, Lane and McDonald 2002).

Institutional change occurs through passing new statutes, court decisions that alter common law, rules changed by regulatory organisations, and constitutional changes that alter the rules by which other rules are made (North 1990, Scoones 1999, Haller 2000). These changes are mostly designed and initiated by politicians and resource managers (Walters 1997). The emergence of new information that sheds light on the inadequacies of current institutions to protect biological and ecological values in the community is frequently a trigger for institutional change (Knuth and Nielsen 1989, Flora and Flora 1993, Heltberg 2001).

In order for institutional change to be effective, resource-users must comply with and adapt to its requirements. Changes may require resource-users to alter their level of access to the resource, their level of harvest or the methods by which they harvest. A problem with implementing institutional change, however, is that it can have adverse effects on resource-users, especially depending on how it is perceived (Wilson et al. 1994, Arrow et al. 1995, Green 1999, Allison and Hobbs 2004). In many instances, the costs and benefits of resource protection are redistributed and can alter the social dynamics within a community. Changes can be introduced too rapidly (Smith 1995, Rannikko 1999), or too frequently, where cumulative impacts become observable (Force et al. 1993). In these ways, the ways in which policy changes are perceived can accelerate the rate at which thresholds of coping are reached, and can erode the resilience of resource-dependent people (Vayda and McCay 1975, Symes 1996, Turner 2000, Wingard 2000).

A better understanding of how institutional change can affect social resilience is important for achieving effective resource governance (Andrews 1997, Brunkhorst 2002). Such knowledge can assist in the design of resource policies that not only protect ecological values, but also protect the resilience of the social systems dependent upon them (Burdge 1987, North 1990b, Curtis et al. 2000). The aim of this chapter is to develop a conceptual understanding of how the perception of institutional change can influence the resilience of resource-dependent users. I do this by examining the key elements of institutions and how they can affect people. Knowledge about the role of key characteristics of policy change in determining the response of resource-users is integral to an operational understanding of social resilience.

4.2 The institutional basis of resource governance

The institutional basis of resource governance is important to examine as it can provide some insight into the ways in which institutional change is designed and implemented within a community. Strengths and weaknesses can be more easily recognised and the relationship between resource-users and natural resource management agencies can be better understood (Holling and Meffe 1996).

To a large extent, natural resource management organisations have been established in response to the phenomenon coined the 'tragedy of the commons' (Berkes 1985, Sandler and Sterbenz 1990, Haller 2002). Hardin (1968) proposed this term to explain situations where there are no incentives for individuals to practice self-restraint in the harvesting of open-access natural resources. Such behaviour would not guarantee that benefits will accrue to these individuals rather than to others. The most sensible strategy for any individual accessing common pool resources, according to Hardin (1968), is to maximise harvesting activity prior to somebody else doing so (Smith 1973). To Hardin (1968), "therein is the tragedy. Each man is locked into a system that compels him to increase his (share) without limit – in a world that is limited…Freedom in a commons brings ruin to all" (page 1245).

(Hardin 1968) believed that the only solution to sustaining the capacity of natural resources to provide goods and services into the future was to regulate the way in which resources are used using legal institutions administered through a central government organisation or transforming common pool resources into private property (Ostrom 1999). Hardin's principles for addressing the dilemma of the 'tragedy of the commons', however, have come under increasing challenge by many researchers on the basis that the assumptions underpinning Hardin's theory occur only rarely and solutions are more feasible than he proposed (Berkes 1985, Wilson et al. 1994, McCay and Jentoft 1996). In many countries, for example, resource conservation is practised as part of normal community-based traditional life in which resource-use is regulated without the presence of legal institutions administered by an outside government, or by transforming resources into private property (Mace 1993). Cinner (2005) provides an example in which a number of villages in Papua New Guinea refrain from fishing in particular areas for parts of the year in order to guarantee plentiful catches at festival times. Festivals are crucial in the maintenance of successful links with trade partners upon

whom they depend for a variety of commodities. In these communities, cultural practices provide incentive for self-restraint in the use of common-access resources.

In another example, traditional community-based fishery councils called 'Panchayats' on the east coast of India provide a broad framework for managing livelihoods and the way in which the community interacts with the environment (Salagrama 2003, Anon. 2005). Panchayats are holistic in their philosophies and governance, and emphasise security, sustainability and equity. In so doing, they do not just provide an equitable mechanism for resource management, but also serve an important welfare function. They act as a link between the local community and the external world, taking community grievances to government bodies, which generally reside elsewhere, and act as the first point of contact for anyone visiting the village from outside. Importantly, the decision-making process is participatory. They have been very successful at managing local fishing activity, probably because they are directly connected to the natural and social environment and are flexible enough to cope with change and, importantly, have strong local support (Anon. 2005). Despite the resources being accessible to the broader community, over-harvesting is prevented without centralised control.

Throughout the Western world, however, the sentiment behind the 'tragedy of the commons' (Hardin 1968) underpins the founding philosophies of the majority of natural resource management agencies (Ostrom 1999, Haller 2002, Hughes et al. 2005). Many governments have taken over the responsibility of resource management and set up governance systems with the intent of protecting natural resources from over-exploitation through legally enforced institutions such as constitutions, laws, policies and rules (Ostrom 1999, Haller 2002). In these settings, resource-users have very limited responsibility in the governance of resources. Holling and Meffe (1996) describe this approach as the "command and control" approach. Holling and Meffe (1996) believe that resource managers using this approach eventually lose sight of their original purpose, tend to eliminate research and monitoring, and focus on efficiency of control. They warn that the command and control approach can lead to the "pathology of natural resource management", where loss of system resilience occurs through inappropriately designed and implemented institutions that do not take into account the dynamic nature of socio-ecological systems (Holling 1996, Holling and Meffe 1996, Folke et al. 2002c, Trosper 2003a, Holling 2004b).

4.3 Characterising institutional change

The key elements of institutions and how they can affect people are important to identify in order to develop a conceptual understanding of how institutional change can impact on resource-users. Vast numbers of studies have documented the consequences of policy change within resource-dependent communities. Few, however, have identified the specific elements of resource policies that could have been modified in order to minimise the social impacts within these communities. In this section, I introduce key elements of how institutional change might be perceived that might influence the extent and magnitude of associated social impacts and influence social resilience. These elements include the perception of the level of participation in the decision-making process, the perception of the level of equity, the perception of impacts likely to be experienced and the perception of the rate of implementation. These variables are chosen on the basis that they may provide insight into why and how people are adversely affected by institutional change.

4.3.1 Participation in the decision-making process

The decision-making process is the process by which decisions that determine how the costs and benefits associated with resource harvesting are resolved. The extent of community participation in the decision-making process is an important feature of institutional change that can influence the social consequences of resource management (Beckley 1995, McCay 1996, Symes 1996, Torsvik 2000). The extent to which people are involved in the decision-making process is varied and can be described using Arnstein's eight rung ladder of citizen participation (figure 4.1) (Arnstein 1969, Coakes 1998).

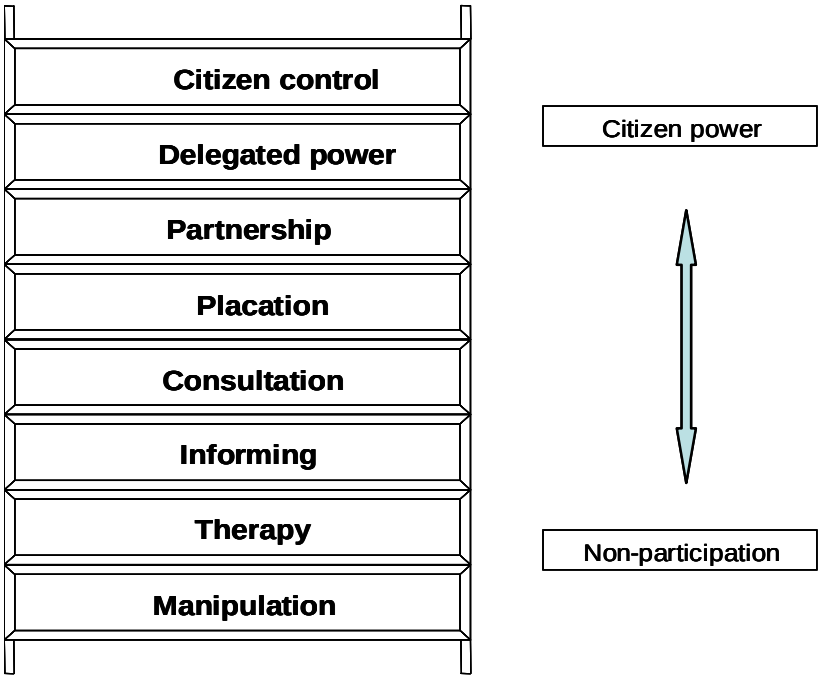


Figure 4.1. Arnstein's eight rung ladder of citizen participation adapted from Arnstein (1969)

The spectrum covers three main categories. The lowest rungs, labelled "manipulation" and "therapy", are in the non-participation category and are basically a public-relations exercise. This approach is goal-oriented and uses planning and control theory management ('the blue-print approach') (Arnstein 1969, Anon. 2005). The three rungs above, "informing", "community consultation" and "placation" are examples of 'token' participation used by authorities in attempting to fulfil their participation responsibilities while still maintaining the dominant power structure (Burdge and Robertson 1990, Duane 1997, Brody 2003). The top three rungs, "partnership", "delegation" and "citizen control" symbolise degrees of community power. Community power focuses on learning and experimenting (Coakes 1998). It is flexible, values process and creates a much more distributed sense of participation and ownership (Anon. 2005). However, it is also often viewed by policy makers and the community as 'chaotic' because the process is usually non-linear, frequently unclear, ridden with conflict and participants often have limited knowledge of the full context of their role in the process and of the role of institutions (Manring et al. 1990, Hanna and Smith 1993, Buchy and Race 2001, Hiedanpaa 2005).

Arnstein (1969), living and working in the USA during the period of student movements and social rethinking of the 1960s, summed up the idea of public participation as, "the idea of citizen participation is a little like eating spinach: no one is against it in principle because it is

good for you. Participation of the governed in their government is, in theory, the cornerstone of democracy - a revered idea that is vigorously applauded by virtually everyone. The applause is reduced to polite hand claps, however, when this principle is advocated by the have-not blacks, Mexican Americans, Puerto Ricans, Indians, Eskimos and whites. And when the have-nots define participation as redistribution of power, the American consensus on the fundamental principle explodes into many shades of outright racial, ethnic, ideological, and political opposition".

Historically, however, the approach of most resource management organisations has tended towards the bottom of the ladder, where participation is lower and local knowledge and values are less valued (Crean 1999). This tendency seems to reflect an attitude that local people will adapt to institutional change on their own accord, and that local customs, knowledge and attitudes are irrelevant to the long-term success of institutional goals (Rickson et al. 1990). Community-consultation ranks only in the bottom-half of Arnstein's ladder because, although the community may be consulted on important management issues, the decision-making power is held elsewhere. There is typically a lack of transparency in the process and a limited degree of accountability in determining whether the consultation has been carried out to any degree of community satisfaction (Coakes 1998).

Researchers in many countries around the world believe that people affected by a new policy are rarely, if ever, fully involved in the decision-making process (Beckley 1995, Jentoft and McCay 1995, Millar and Curtis 1999, King 2003). In countries such as Australia, Canada and the USA, however, resource management organisations often employ an approach that lies somewhere around the 'middle' of Arnstein's ladder (Curtis and De Lacy 1996, Coakes 1998, Race and Buchy 1999, Nelson and Pettit 2004). The important point is, however, that where the community is engaged in the decision-making process, as described by approaches towards to top of Arnstein's ladder (Pomeroy 1999, Pomeroy and Beck 1999, Chong 2000, Helvey 2004), the uncertainty of social outcomes associated with institutional change is reduced and the likelihood that social outcomes are expected and 'desirable' is increased (Ludwig et al. 1993, Anderies et al. 2004).

Social scientists seem to be unified in promoting the advantages of increasing the level of involvement towards the upper reaches of Arnstein's ladder (Jentoft and McCay 1995). Community involvement, incorporated early in the process of institutional change, can provide a valuable mechanism to better understand and assimilate the needs and concerns of

local people (Fricke 1985, Craig 1990). In addition, the level of scientific uncertainty associated with institutional change becomes less critical when people likely to experience the change are involved in the process (Rickson et al. 1990a, Walters 1997, Wilson 2003). Other researchers have shown that forms of governance that challenge the 'top-down' approach are currently the best strategies to prepare for change (Folke et al. 2002c, Walker et al. 2004, Folke et al. 2005, Olsson et al. 2005).

Another important value for community participation in the decision-making process is that resource-dependent people are more likely to accept institutional change (Olsson et al. 2004). Involving the community at initial phases in the policy decision-making process can reduce conflict and increase the efficiency in producing workable outcomes (Burdge and Robertson 1990, McCay and Jentoft 1996, Margerum 1999, Pomeroy 1999, McCay 2000). Involvement increases the likelihood that communities will trust the motivation behind new policies and understand their rationale and intended outcomes (Putnam 1993, Bowler and Donovan 2002, Ward and Hegerl 2003). Lack of trust is a chronic problem in many resource industries, crucially undermining the success of policy initiatives (Levin et al. 1998, Jones 1999, Chong 2000, Harms and Sylvia 2001). A trusting relationship is economically important in the management of natural resources since it reduces management and 'transaction costs' (Chong 2000, Torsvik 2000). Transaction costs refer to the time and money that government agencies spend interacting with industry and the community (Lane and MacDonald 1999, Torsvik 2000). A trusting relationship with decision-makers can increase the efficiency with which management agency goals can be reached (Burdge and Robertson 1990, Fortin and Gagnon 1999, Torsvik 2000). In the fishing industry, for example, fishers that do not trust the motivations behind institutional change are 'pathologically resistant' to what they view are unjustified or inequitable impositions (Hanna 1996, Symes 1996, Harms and Sylvia 2001).

Governance systems that actively involve community members in the decision-making process and are flexible and open are believed to assist in the maintenance of social resilience (Ostrom 1999, Carpenter and Gunderson 2001, Folke et al. 2002b). The adaptive capacity of resource-users can be enhanced since the system can experiment and learn from different strategies and incorporating new information into the design of new strategies (Ostrom 1999, Folke et al. 2002a, b).

4.3.2 Perception of equity in institutional change

An important feature of institutional change is the perception of the extent to which equity issues are addressed (Charles 1992, McCay 1996, Campbell 1997, Cochrane 2000). Imposing limits on resource use raises the question of which users will have rights to the resource, and who will be excluded (Healey and Hennessey 1998, Jentoft et al. 1998, Stedman 1999). Resource-dependent communities may share the common goal of sustaining a resource; however interests often differ when deciding how to divide access and use (Jentoft et al. 1998, Ostrom 1999). Importantly, the process of distributing the costs and benefits of resource protection can severely erode social well-being and quality of life where feelings of injustice can lead to feelings of hopelessness, despair and anger (Bailey and Pomeroy 1996, Bass 1998, Salz 1998, Waitt and Hartig 2000). Baland and Platteau (1999) refer to the overexploitation of common-property resources, as a way of examining the effect of inequality, and show how inequality in the distribution of access to the resource can have an ambiguous impact on local resource management. They show how that disequalising change in the distribution of access rights has two effects which run in opposite directions. People who benefit from a change have a larger stake in the common property resource and therefore have a greater incentive to take conservation measures. Simultaneously, increasing inequality has a corresponding disincentive effect on those people whose endowments have been reduced.

The perception of equity in the design of institutional change can affect the ability of resource-dependent people to be resilient. Beckley and Reimer (1999) describe how inequity in the distribution of costs and benefits of timber management has inhibited the sustainability of timber-dependent communities in Canada. Similarly, Reed (1999) also working in the timber-dependent communities in Canada has found that social equity is strongly correlated with social sustainability and resilience. Another problem with not adequately addressing the perception of equity in the management of natural resources is that it can severely undermine the effectiveness of resource management strategies. For example, commercial fishers who believe they have been inequitably imposed upon to bear the costs of change have been described as 'uncooperative' and 'pathologically resistant' in incorporating the change into their working lives (Hanna 1996, Symes 1996, Harms and Sylvia 2001, Jabareen 2004).

Resource-users often perceive they have been inequitably asked to bear the costs of resource protection (Chong 1994, Bass 1998). Although resource management organisations will usually attempt to be fair (Healey and Hennessey 1998), it can be extraordinarily difficult to

distribute the costs of resource protection evenly (Broome and Valentine 1995, Pezzoli 1997, Bonzon 2000, Cochrane 2000). Many researchers have found that feelings of 'unfairness' and 'unjustness' are sentiments that are especially typical of small-scale, traditional and displaced resource-users with un-transferable skills (McCay 1981, Bass 1998, Salz 1998, Cochrane 2000). These people have also been shown to be the most likely to bear the costs of new policies (Chong 1994, Horton and Hunt 1994, Nord 1994). For example, Davis and Bailey (1996) describe a case study in Nova Scotia where the majority of fishers were prohibited from fishing as a result of a new management strategy whilst a few larger companies were allowed to continue. This occurred because larger fishing companies were apparently better skilled at persuading the government to empathise with them (Davis and Bailey 1996). In an example from Indonesia, the government decided to provide aid to many local fishers by providing better technologies on board their vessels and to purchase bigger vessels through subsidised loans (Bailey and Pomeroy 1996). Their aim was to encourage these (now larger) fishers to move offshore and search for fish elsewhere. However, this initiative resulted in unexpected social consequences. Instead of moving larger fishers offshore, they remained in the coastal areas and used their improved equipment to competitive advantage – placing the smaller-scale fishers at a distinct disadvantage (Bailey and Pomeroy 1996). These examples illustrate how government initiatives can inadvertently and inequitably distribute access to a resource where small-scale resource-users are made to bear the costs of resource protection (Polachek 2002).

The most common policy response to overfishing around the world has been the consolidation of fishing fleets into larger boats (Clay and McGoodwin 1995, Lane and Stephenson 1995, McCay and Jentoft 1996). Taiwan, for instance, has stopped issuing licences to boats smaller than 1,000 tonnes, and has started a buy back scheme for boats older than 15 years (Weber 1995). In South Asia and South-East Asia, larger companies have, in recent years, gained increasing shares of the catches (Bailey 1997). In Victoria, the trawl industry has also consolidated into fewer larger-scale operators (Minnegal et al. 2004). As a result, the tightening situation in world fisheries is threatening to make marine fisheries the 'realm of the world's economic elite' (Weber 1995). For example, Japan is the world's top marine fishing country and catches nearly twice as many fish as China; yet Japan employs only 200,000 fishers compared to China's 3.8 million (Weber 1995). These examples demonstrate that the perception of equity in the design of institutional change is not without merit: perceptions that small-scale fishers are being 'made to leave the industry' appear to be well-founded, and may

thus be an important predictor of how resource-users might respond to a new policy and adapt.

4.3.3 Anticipatory impacts associated with institutional change

A characteristic feature of institutional change is the anticipation of impacts even before any 'real' change has taken place (Freudenberg and Keating 1985, Gramling and Freudenberg 1992, Bennett et al. 2002). The period between policy proposal and policy implementation is a period of uncertainty for resource-users. This period can be extremely stressful for recipients of institutional change (Gramling and Freudenberg 1992, Brabant and Gramling 1997, Fried 2000). As soon as people are aware of an impending policy change, they often attempt to identify, define, and understand its implications. In many instances, people will anticipate impacts on the basis of previous experience (Force et al. 1993, Walters et al. 1999). As Freudenberg and Gramling (1992, page 941) note, "…politicians manoeuvre for position, interest groups form or redirect their energies, stresses mount, and a variety of other social and economic impacts take place, particularly in the case of facilities that are large, controversial, risky, or otherwise out of the range of ordinary experiences for the local community."

The conclusions that people reach can have significant effect on their ability to cope with the change and adapt (Gramling and Freudenberg 1992). The anticipation of impacts associated with planned changes have sometimes been called 'pre- development' or 'anticipatory' impacts, but they are far more "real and measurable than such terminology might imply" (Gramling and Freudenberg 1992). If people perceive that an institutional change will have an adverse effect on their ability to survive within the industry, their proximity to their threshold of coping will draw closer and they will be even less prepared to adapt to the change once it is actually implemented.

When conditions becomes uncertain and highly disorganised, people's sense of security, morale and purpose in life are damaged, and when people are in this state, their behaviour can become inconsistent, hesitant, and contradictory. Frequently people become resigned, apathetic and 'demoralised' which can lead to a variety of physical and mental illnesses (Hanna 1996, Symes 1996, Harms and Sylvia 2001, Jabareen 2004). For these reasons, the extent to which impacts associated with changes in resource are anticipated may be an important predictor of how resource-users might respond to a new policy and adapt.

4.3.4 The rate of implementation of institutional change

Another important feature of institutions is the rate at which change is implemented (Ogburn 1972, Machlis and Force 1988, Gramling and Freudenberg 1992). For any change to be incorporated into people's lives, sufficient time is required in order to allow 'diffusion' and adaptation processes to occur (Rannikko 1999). Diffusion is the process by which information about an impending change is introduced and dispersed through a community. Information and awareness of opportunities, threats and alternatives can be considered by those directly and indirectly affected. This information allows people to evaluate how the change may affect them and gives them the chance to identify and implement measures or strategies to adapt (Parsons 1966, Swanson 1971, Gramling and Freudenberg 1992, Fenton and Carr 2001). This deliberation is often a complex and lengthy process; the success of which is influenced by the extent and strength of social networks and social exchange, and by the amount of human, economic and social capital within a community, as well as by the amount of time between knowledge of impending change and the actual change event (Horton and Hunt 1984).

The rate of implementation of change is an especially important consideration for communities with high 'cultural inertia'. Communities with a high cultural inertia have a strong sense of tradition, are less willing to adapt to change and are slower to accept change; "culture once in existence tends to exist for the reason that it has utility, very much as a physical mass at rest tends to remain at rest" (Ogburn 1972 page 48). For example, a culture which places great authority in its older members (e.g. China) is more likely to be conservative and not as responsive to vectors of change (Horton and Hunt 1984). When such a culture has been relatively static for a long time, people are likely to assume that it will remain so indefinitely and remain especially resistant to change. Western society, in contrast, has low inertia and is generally regarded as being highly conducive to absorbing social change since there is a relatively high level of individualism, a lack of social rigidity, a high proportion of achieved statuses, and institutions that encourage rapid social change (Horton and Hunt 1984).

Many resource-dependent communities are particularly prone to developing cultural inertia (McCay 1978, Marshall 2001). Communities such as fishers, miners, loggers and farmers develop a strong cultural identity which makes them typically resistant to change (Tunstall 1969, Nesbit 1972, Salaman 1974, Horton and Hunt 1984). Resource-dependent people need sufficient time to become familiar with and accept the requirements of institutional change. Resource policy changes that are implemented into resource-dependent communities without

due consideration of the time required for diffusion and adaptation processes to occur, are likely to be met with resistance or apathy (Hanna 1996, Symes 1996, Harms and Sylvia 2001). The rate at which resource policies are implemented into a resource-dependent community may thus be an important predictor of how resource-users might respond to a new policy and adapt.

4.4 A conceptual model of the influence of institutional change on resilience

While the literature contains an abundance of case studies describing the role of institutional change in resource-dependent communities, there are few attempts to synthesise the findings into a holistic conceptual framework that can guide theoretical and applied work on the role of institutional change in the maintenance of social resilience. This chapter has revealed that there are certain elements of the way in which institutional change is perceived that can influence social outcomes and affect the way change is accepted and incorporated into a community. These elements are summarised as a conceptual model in figure 4.2. Figure 4.2 suggests that involvement in the decision-making process, the perception of equity addressed, the anticipation of impacts and the perceived rate of implementation can affect the ability of resource-users to be resilient to changes in policy. The literature suggests that feelings of uncertainty, lack of trust and hopelessness are the likely social outcomes that can be initially expected as a result of changing the user-resource relationship. The model builds on emerging theory about the role of institutional change in resource-dependent communities, and provides a framework for refining our understanding of how policy change can be modified so that people will perceive it more positively and can more easily cope and adapt. Because the elements within the model can be measured relatively easily, the conceptual model provides a basis for measuring the perception of policy change. The model developed in figure 4.2 and its utility in guiding policy development processes are tested and explored in chapter 9 using the commercial fishing industry in North Queensland.

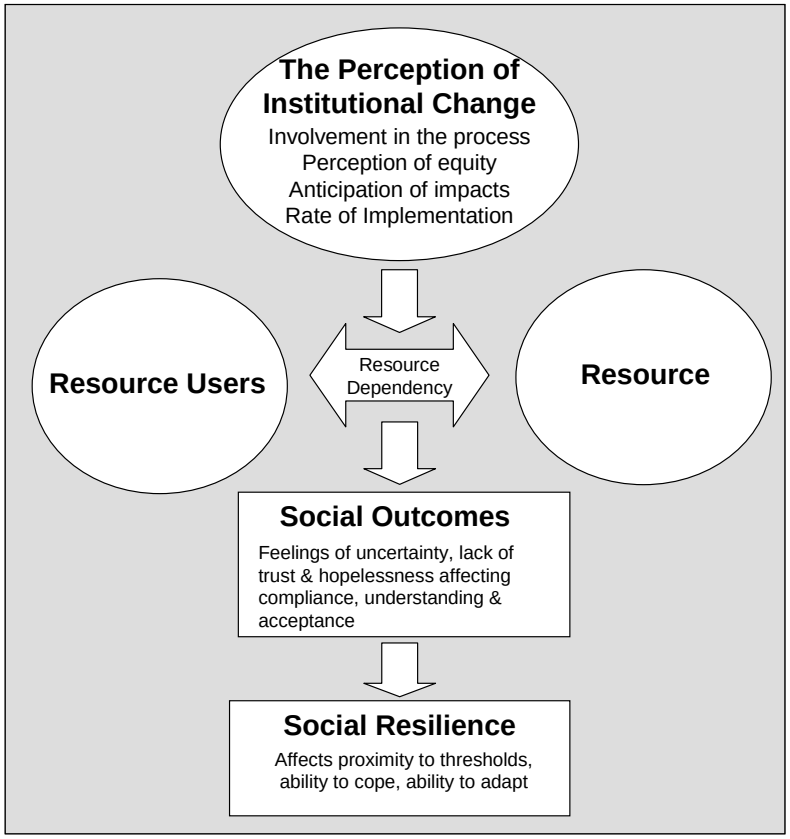


Figure 4.2. A conceptual model of the key features of institutional change and their influence within resource-dependent communities.

Chapter 5.

5

A Conceptual Development of Social Resilience within the Commercial Fishing Industry

"One of the advantages of being disorderly is that one is constantly making exciting discoveries."
A.A. Milne (1882-1956), creator of 'Winnie-the-Pooh'.

5.1 Introduction

In 2000 Adger proposed that social resilience was a function of both the level of dependency of communities on the resource and of the institutional context within which resource-users were subjected. This concept has since received very little attention, yet it is fundamental to understanding how resource-users respond to policy change and adapt (Adger et al. 2002). It intimates that close relationships exist between social resilience, resource dependency and the institutional context; the significance of which is yet to be determined. These concepts are, however, ambiguous and not directly observable.

The aim of this chapter is to provide a conceptual understanding of how social resilience, resource dependency and institutional change might be measured and how they might be related. The measurement of these concepts enables the relationships between them to be tested and an 'operational' understanding to be developed. In this way, a conceptual model represents an abstract version of a hypothesis. The model is developed by assimilating knowledge from the previous chapters. In the remaining part of this thesis the model is tested for its applicability to the commercial fishing industry in North Queensland.

5.2 A conceptual model for social resilience

A conceptual model of social resilience for the commercial fishing industry was developed on the basis of Anderies et al.'s (2004) conceptual model of a socio-ecological system. In

Anderies et al.'s (2004) model, the important linkages that exist between resource-users and the resource (resource dependency), between resource agencies and resource-users (the institutional context), and between policy changes and resource dependency were made explicit. Anderies et al.'s (2004) model is modified here to increase its applicability to the commercial fishing industry in North Queensland and to emphasise that there are social consequences as a result of the linkage between policy change and resource-dependency. The modified model is presented in figure 5.1.

Figure 5.1 shows that:

(i) Social resilience (A) is a description of the ability of people to cope and adapt to institutional change. It is mediated by the perception of institutional change and resource dependency.

(ii) Resource dependency is a description of the relationship between resource-users (B) and the resource (D). People are dependent on the benefits obtained from the resource because of their social, economic and environmental characteristics.

(ii) The perception of institutional change (C) can affect the relationship between resource-users and the resource (dependency) by affecting the level of social, economic and environmental benefits obtained from the resource, thereby affecting social resilience.

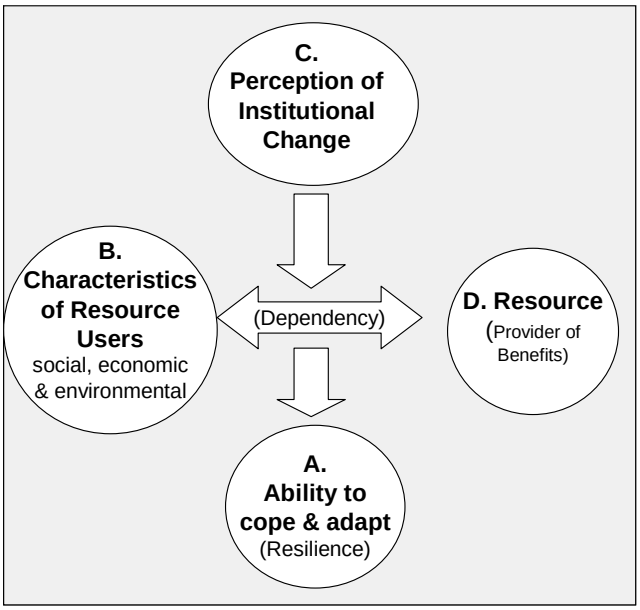


Figure 5.1. A conceptual model of social resilience for the commercial fishing industry

5.3 Testing the model on the commercial fishing industry

In order to refine and improve the generality of the conceptual model, the model needs to be tested within a resource-dependent industry or community that is subject to institutional change affecting access or use of a resource. Once the applicability of the model has been established, resource managers can potentially use it to assess the social outcomes associated with various policy options. Strategies can be designed so that optimal outcomes for the socio-ecological system are achieved. In this study, the model was tested on the commercial fishing industry in North Queensland.

The approach taken to test the conceptual model was to operationalise each of the conceptual variables in figure 5.1 (A, B and C) and assess the significance of the relationships between them.

On the basis of the conceptual development of the literature in chapter 2, social resilience (A) was hypothesised as being a measure of well-being. In order to assess well-being of the commercial fishing industry, it was proposed that commercial fishers self-assess their expected level of well-being in terms of acceptability, flexibility, other opportunities and willingness to be creative and novel in their approach to adapting to the requirements of policy change.

On the basis of the conceptual development of the literature in chapter 3, characteristics of resource-users (B) that describe their level of dependency on the resource (D) were hypothesised as comprising social, economic and environmental factors. Social characteristics included the level of attachment to the occupation, level of attachment to the community, employability and family circumstances. Economic characteristics included the business size, business approach and financial situation (debt levels and income). Environmental characteristics included the level of specialisation and time spent harvesting. In order to assess each of these characteristics it was proposed to present relevant survey questions to a sample of commercial fishers and their families.

On the basis of the results obtained in chapter 4, the perception of policy change (C) was hypothesised as comprising measures of the level and perceived quality of involvement in the decision-making process, the perception of equity and anticipatory impacts likely to be experienced and the perception of the rate of implementation. These measures are quantified through standard survey techniques.

In order to assess the relationship between variables, the relationship between variables is examined. Those components of the independent factors (resource dependency and policy perception) that are not observed to be significantly correlated with social resilience will be removed from the model as it currently stands. In this way, it is expected that the conceptual model developed in this chapter will be operationalised for the commercial fishing industry in North Queensland.

5.4 A note on the level of analyses used

Because of its institutional context (Adger 2000), social resilience has been mostly defined at the community level: individual resilience is rarely studied in understanding system resilience, and hence individual resilience receives relatively little attention (Levin et al. 1998, Adger 2000). Understanding social resilience at an individual level, however, is likely to be extremely important in understanding social resilience at broader levels of analysis (Meffe 2001, Adger et al. 2002, Manfredo and Dayer 2004). In navigating through transitional periods, for example, key individuals have been observed to be critical features in transforming communities into more desirable social states (Olsson et al. 2004, Folke et al. 2005, Olsson et al. 2005). A community-level analysis of social resilience, although vitally important to understand the concept at multiple scales, is potentially masking the fundamental underlying mechanisms that confer resilience: how people cope with policy change and adapt (Machlis et al. 1990, Freudenberg and Gramling 2002, Mascia et al. 2003, Trosper 2003b). Emphasis on the role of policy change at an individual unit-of-analysis may further progress our understanding of how resource-dependent people can be assisted so as to increase their capacity to be resilient to future policy change (Smith 1995, Salz 1998, Smith et al. 2003, Bradley and Grainger 2004). Understanding individual response to institutional change may thus increase the general applicability of the resilience concept for resource managers.

Scale is an important issue in understanding socio-ecological systems (Dumanski et al. 1998, Lovell et al. 2002, Allison et al. 2003, Hughes et al. 2005). A systemic understanding of social resilience requires knowledge of multiple temporal and spatial scales. Resilience at each level (i.e. individual, industry, community and global scales) has its own set of processes and structures that play out over several scales of space, time and organisation (Begossi 1998). Each set of processes and structures are understood to interact across these multiple scales with complex and varied linkages also existing between the social, ecological and economic

components of the system ('panarchies') (Gunderson and Holling 2002, Walker and Meyers 2004). These cross-scale effects are of great significance in the dynamics of socio-ecological systems, where it is generally accepted that it is not possible to understand a system at only one scale (Walker et al. 2004). For the concept of social resilience to become more constructive and functional, research that aims to understand the linkages between scales and system components is needed (Meffe 2001, Adger et al. 2002, Manfredo and Dayer 2004).

Finally, this study concentrates on the resilience of individual fishers. Household data are collected but only too examine the role that the household might have in determining fisher resilience.

Part B.

An Operational Understanding of Social Resilience in the Commercial Fishing Industry in North Queensland

Chapter 6
Operationalising the Concept of Social Resilience for the Commercial Fishing Industry: Methods

6

"Such is the paradox of the social sciences. Familiarity bestows comfort, and comfort breeds carelessness and error. Most people believe they know how they themselves think, how others think too, and even how institutions evolve. But they are wrong…"

E.O. Wilson (1998), in 'Consilience. The Unity of Knowledge'
Little, Brown and Company, London

6.1 Introduction

The discipline of social science associated with natural resource management is rarely associated with being a 'real' or 'hard' science (Wilson 1998). Perhaps this is because the subject matter is so fluid, difficult to observe and hard to measure precisely with scientific instruments. Perhaps this also explains the slow pace with which the social sciences have been incorporated into natural resource management.

Social research is about using a scientific process to produce new knowledge about the social world. Forming and testing hypotheses using rigorous and clearly articulated methods are imperative. Yet, several researchers within the social sciences have lamented the problems associated with the lack of rigorous and comparable methodology in light of interpreting other people's work (Schweitzer 1982, Overdevest and Green 1995, Belsky 2002). Standard procedures appear to be rarely employed. For example, Overdevest and Green (1995) conducted a literature review on the link between forest dependency and well-being in rural communities and found that evidence was inconclusive as the methods used between studies were incomparable. This has most likely hindered advancement in knowledge in the social sciences and its practical incorporation into natural resource management. At the same time, however, in many natural resource management cases, social studies providing a strong foundational basis are rare.

In order to increase the likelihood that social knowledge might be incorporated into the management of natural resources, it was considered important to execute a research study that included quantitative data and analyses so as to facilitate communication with natural resource managers. Natural resource managers typically emerge from the natural sciences (Hanna and Smith 1993, Harms and Sylvia 2001) and many conflicts between natural resource managers and other members of the community are believed to occur because of differences in the perceived importance of 'data' (Putra 2002, Capitani et al. 2004). The natural sciences generally favour quantitative data, probably because their significance is more readily apparent (Underwood 1997, Johnson 1999, Pajak 2000).

In this study, both quantitative and qualitative data techniques were used (a 'mixed methodology'). Quantitative research uses methods adopted from the physical sciences that are designed to ensure objectivity, generalisability and reliability (Underwood 1997, Becker 1998). These techniques cover the ways research participants are selected randomly from the study population in an unbiased manner, the standardized process they experience and the statistical methods used to test predetermined hypotheses regarding the relationships between specific variables. The researcher is considered external to the actual research, and results are expected to be replicable no matter who conducts the research (Weber 1985, Weinreich 1996).

Qualitative data provides an opportunity to provide depth and insight into the findings of quantitative data. The social sciences have tended to test hypotheses through the use of qualitative data more than in other scientific disciplines. Qualitative research methodologies are designed to provide the researcher with insight about research subjects through immersion and direct interaction, where rich, detailed data is generated. These methods are designed to help researchers understand the meanings people assign to social phenomena and to elucidate the mental processes underlying behaviours. In the qualitative paradigm, the researcher becomes the instrument of data collection and results may vary greatly depending upon who conducts the research (Weber 1985, Weinreich 1996, Milestad and Hadatsch 2003).

The approach taken to test the applicability of the conceptual model developed in chapter five to the commercial fishing industry in North Queensland proceeded through five basic phases:

i. to use the theoretical model to develop survey questions that would determine an individual commercial fisher's response to generic changes in fisheries policy, their level of dependency on the resource and their perception of policy change

ii. to refine the survey questions through a scoping and pilot study

iii. to administer the survey to 100 commercial fishers and their families in five coastal communities in North Queensland

iv. to validate and interpret the results of the survey by qualitatively interviewing the same 100 commercial fishers and their families

v. to analyse quantitative and qualitative data to assess and refine the applicability of the conceptual model to maximize its relevance to the fishing industry.

The purpose of this chapter is to describe how each of these phases was executed and to describe the techniques and study sites used.

6.2 Study Sites and Community Profiles

Five coastal communities in North Queensland were chosen as study sites for the research: Cooktown, Port Douglas, Innisfail, Townsville and Bowen (Figure 6.1). These communities were selected to represent main coastal communities in the region with established fishing communities and a range of population sizes and proximities to major regional centres (see table 6.1).

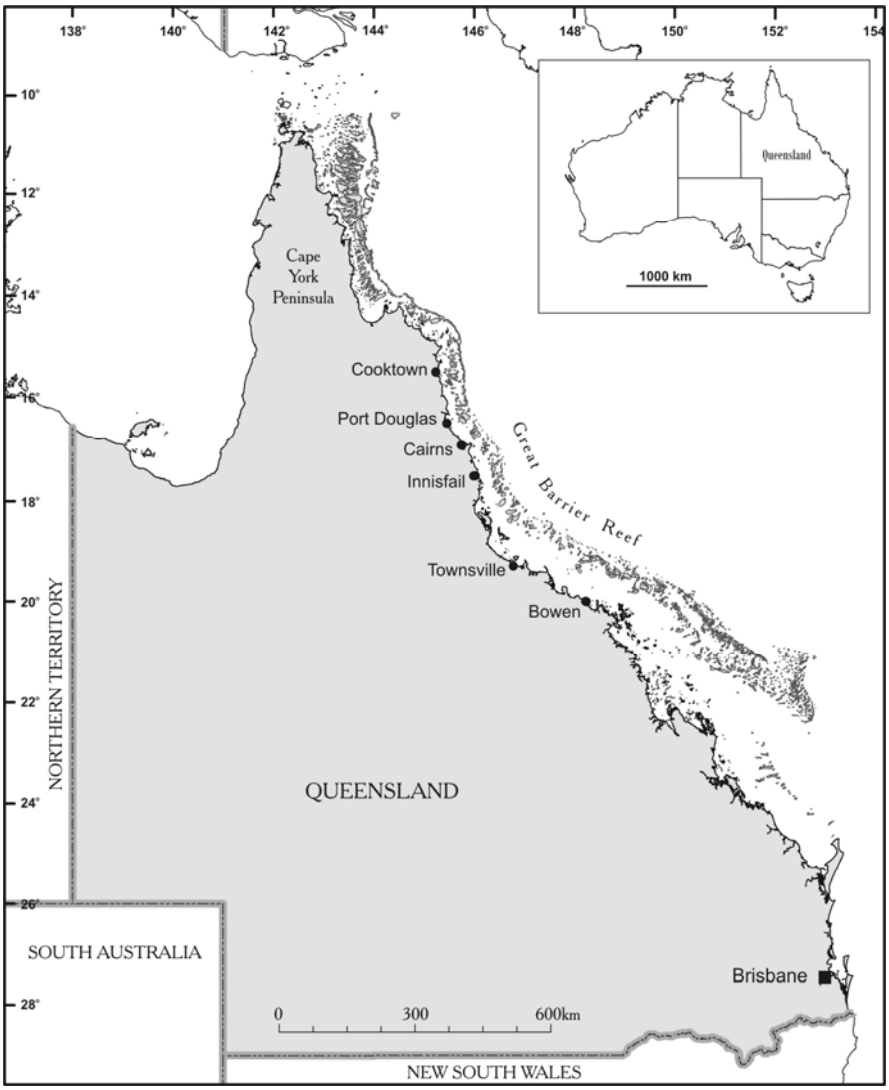


Figure 6.1. A map of Queensland showing the location of the five communities used in the study and the reference points of Cairns and Brisbane.

Cooktown was the smallest of the communities in the study (~1,800 people). Cooktown is the most northern non-indigenous township along the east coast of Australia. It became established in the 1870s as a small port because gold was found in nearby rivers (www.cooktowns.com). Cooktown supports an 'outback' or four-wheel drive tourism industry and is the main regional centre for surrounding graziers. It is often referred to as a 'frontier' community because of its isolation from major regional centres. During some parts of the year, its isolation is even further emphasized since the area is subject to flooding and all-year road access to the township has not been possible until relatively recently.

Port Douglas has undergone a massive cultural change over the last 20 years. Although also initially established in 1877 because of nearby goldfields, Port Douglas was a small fishing

village and a sugar port for most its history. In 1960 the population was 100. Since the 1980s however, Port Douglas has become famous as a popular holiday destination for Australians and international visitors, and now supports a local community of over 4,000 people (http://www.portdouglaswebs.com.au/port_douglas_history.htm).

Innisfail was established in 1880, in part for the nearby goldfields, and in part to develop a variety of agricultural enterprises. Sugarcane became the major source of income upon which the township became established. The region is now also Australia's largest producer of bananas, rivalling sugar as an income earner. Commercial fishing represents a significant proportion of the income for the town (www.gspeak.com.au/Innisfail/hist).

Townsville is the largest of the communities chosen. Townsville is a major regional centre with a population size of over 91,000 people. Townsville was founded in 1864 as a port for the surrounding pastoral industry. Following the discovery of gold in the region, the town developed into the principal centre in North Queensland (www.townsville.qld.gov.au/about/heritage).

Bowen was founded in 1861 as the most suitable port north of Rockhampton. It was established as the administrative centre for the region, but Townsville soon overtook it, mainly because gold was found inland from Townsville. Bowen is mostly within a cattle-grazing region, and is also supported by a salt-works factory producing nearly 30,000 tonnes of salt a year, coke (up to 38,000 tonnes a year) and a tomato-processing plant (4 million cartons) (www.answers.com/topic/bowen-queensland).

Each of these communities supports a relatively small proportion of commercial fishers (table 6.1), which is typical of coastal townships in North Queensland (Fenton and Marshall 2001a, b, c). Of the communities included in this study, Innisfail has the highest proportion of fishers, with 1.7% of the population engaged in the commercial industry (table 6.1). Townsville has a relatively small proportion of fishers (0.2%), yet it provides 11.3% of Queensland's fisheries Gross Value of Production (GVP) (table 6.1). Cooktown is the smallest contributor of GVP in Queensland, contributing less than 1% to the Queensland total (Fenton and Marshall 2001a).

Table 6.1. General characteristics of each community within the study*

Town	Population	No. of Fishers	%Fishers in Town	GVP** Fisheries	%QLD GVP
Cooktown	1,800	15	0.8	$1,502,000	0.5%
Port Douglas	4,000	34	0.8	$4,729,000	1.5%
Innisfail	8,000	134	1.7	$12,611,000	4.0%
Townsville	90,770	153	0.2	$35,487,000	11.3%
Bowen	9,000	70	0.8	$10,563,000	3.4%

Notes: * Adapted from Fenton and Marshall (2001a)
**GVP=Gross Value of Production

Table 6.2 provides information about the social characteristics of commercial fishers in each township based on data collected by Fenton and Marshall (2001a). Although some characteristic differences can be observed between the towns, the average age of fishers between towns were within 4 years of each other, most were married with more than two dependents and the average take-home income ranged between $22K and $40K (table 6.2). Fishers within each community are, on average, between 43 and 47 years of age (table 6.2) (Fenton and Marshall 2001a). Differences between communities were apparent in the number of years operating as a fisher, debt levels and education levels (table 6.2). Fishers in Cooktown have owned their businesses for relatively fewer years than fishers in other communities. Fishers in Cooktown also have a relatively lower debt level associated with their business and a correspondingly lower mean income, higher level of formal education, and a lower mean number of dependents living at home. Innisfail, on the other hand, has the oldest owned fishing businesses. Townsville fishers take the most income home each year, and fishers in Port Douglas are more likely to have a higher debt level associated with their business and are less likely to be married (table 6.2) (Fenton and Marshall 2001a).

Table 6.2. General social characteristics of fishers in each community*

Town	Age	Years in operation	Debt level	% Own home	% Yr 12	% Married	Family size	Income
Cooktown	47.2	7.6	6%	33%	33.3%	66.7%	2.3	$22,167
Pt. Douglas	44.3	12.4	40%	25%	8.3%	58.3%	2.9	$28,000
Innisfail	45.9	15.6	19.4%	53.7%	11.1%	81.5%	3.4	$37,714
Townsville	45.6	12.5	23.6%	40.4%	21.8%	78.9%	3.5	$39,818
Bowen	43.2	10.7	17.1%	40.4%	15.4%	80.8%	3.8	$34,640

Notes: * Adapted from Fenton and Marshall (2001)

6.3 Assessing resilience, resource dependency & perception of policy

Resilience, resource dependency and the perception of policy change are constructs that were quantified using standard survey techniques. The development of a survey is a typically multi-step process in which a scale to measure a construct is created. Spector (1992) devised a model (figure 6.2) to encapsulate five major steps in the development of a scale. He suggested that the constructs needed to be well defined. A scale is then designed, pilot-tested and modified as often as necessary to ensure that the scale is as representative of the construct as possible. Once the scale is deemed satisfactory, it can be administered to the sample of respondents to be examined. Responses then need to be analysed for their internal consistency. Spector (1992) further suggests that this process may need several iterations before a satisfactory scale measuring a construct is developed. Once a scale is established on the basis of the data at hand, Spector (1992) suggests that it be validated and normalised using other techniques.

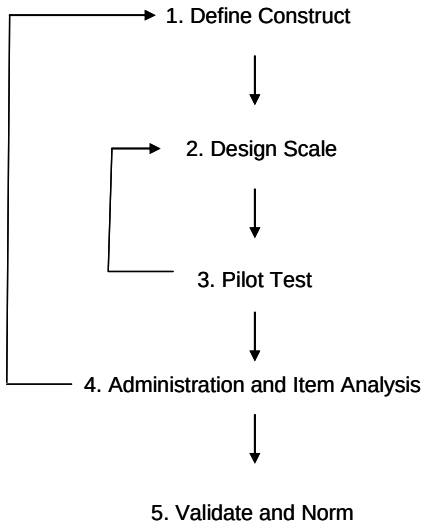


Figure 6.2. Five major steps in the development of a scale (based on Spector (1992)).

In this study, scales were developed to quantify the constructs of resilience, resource dependency and the perception of policy change. Each was defined in preceding chapters and summarised in chapter 5. The Likert scale (Likert 1932) was used to quantify each construct in most instances. In 1932 Likert developed the summated rating scale to measure attitudes. Since then the 'Likert scale' has been widely used to measure opinions, personalities, and emotional states as well as to describe activities (Spector 1992). The Likert scale is particularly

useful in estimating ambiguous constructs in natural resource-related fields where multiple statements are combined or summed to provide a useful and measurable composite.

6.3.1 Phase 1. The scoping study

In order to assist in grounding the conceptual variables and questionnaire items within the context of the commercial fishing industry, a scoping study was undertaken. Fifteen fishers in Townsville and their wives or partners were contacted in August and September 2002 and invited to participate in the study. The purpose of the scoping study was to discuss the development of the main survey to maximise the relevance of the statements to the commercial fishing industry.

Fishing families were identified through the database of commercial fishers at Queensland's Seafood Industry Association (QSIA). The scoping interviews were conducted in a semi-structured manner in the homes of fishers, using standard interviewing methods. I took detailed notes during the interviews and asked open-ended questions about each of the conceptual variables in turn (see table 6.3). Much of the interview sessions also included discussions about life in the commercial fishing industry and personal stories. Where relevant, information that might be useful in constructing a 'picture' of how fishers and their families might respond to change was noted. Interviews lasted approximately 2-3 hours each.

Table 6.3 provides a summary of the results from the scoping study. Although many of the statements in the survey had been identified from previously published studies, the scoping study identified several additional factors for predicting social resilience that were not evident in the literature. For example, fishers and their families involved in the scoping study believed that the level of family involvement in the fishing industry was an important predictor of how a fisher would respond to policy change. Since many fishing businesses were family-operated, the ability to incorporate change also depended on how each family member would be affected. The level of interest in issues of environmental sustainability, for example, was also identified as an important factor by fishing families. Fishing families believed that fishers that were especially interested in the well-being of the environment represented fishers that had had a long association with the industry, were not 'in it' for the money alone, and had a greater vested interest in ensuring that policy change would ensure the long-term viability of the fisheries resource. Fishers sampled in the scoping study believed that these sorts of fishers

would be more receptive to 'sensible' policy change. The additional factors highlighted through the scoping study were included as part of the larger study.

Table 6.3. Variables identified through the literature and through the scoping study as being potentially important predictors of resilience in fisheries policy

Variable	Literature**	Scoping Study
Capacity for learning and adaptation	*	
Attitude to change	*	
Level of education	*	*
Years of experience in industry	*	*
Experience in other industries	*	
Age of fisher	*	*
Strength of identity as a fisher	*	*
Flexibility in business	*	
Level of knowledge of fishing business	*	
Family size		*
Age of spouse		*
Spouse education and employment		*
Level of Spouse's knowledge of fishing business		*
Strength of identity as 'fishing family'		*
'Family' as a priority in life/happiness at home		*
Flexibility in business set-up and financial security	*	
Ability to visualize another life	*	
Size of business (no. of employees & vessels, vessel length)	*	*
Predictability of income	*	*
Buffer capacity as (%)	*	
Level of fishing and non-fishing income	*	
Level of debt	*	*
Level of assets/security/investment	*	
Level of strategic planning in fishing business	*	
No. of previous changes experienced	*	*
Level of participation in fisheries management	*	*
Interpretations of policy	*	*
Attitude towards institutions	*	*
Perception of implementation of policy change	*	
Nature of contact with institutions	*	*
Opportunity to access relief during closures		*
Level of species specialization	*	
Amount of time spent at sea	*	*
Perceived current quality of resource	*	
Predictability of resource	*	
Flexibility of resource use (switching & territoriality)	*	
Awareness of sustainability issues		*

Variable	Literature**	Scoping Study
Knowledge of Marine Environment	*	*
Level of teamwork with other fishing boats		*
Feelings of support from industry	*	*
Feelings of support from community	*	*
Length of residence	*	*
Feelings of support for spouse from industry & community	*	*
Length of residence of spouse	*	*

**literature: refers to references as provided in previous chapters.

6.3.2 Phase 2. Developing the survey: the pilot study

An inductive approach was used to develop the structured survey. This approach essentially builds upon a solid conceptual foundation based on the literature and scoping study (table 6.3) and the conceptual model developed in chapter five (Spector 1992). Some questions such as 'in what year were you born?' required direct answers. Some questions such as 'are you a member of a local management advisory committee?' required a 'yes' or 'no' answer. Most questions, however, were encompassed into a statement and reflected an attitude, opinion or stance. Respondents were asked to rate how strongly they agreed with each statement using a 4-point rating scale (1=strongly disagree, 2= disagree, 3=agree, 4=strongly agree). Fishers that were neutral were asked to leave the response blank. This scale builds upon the Likert scale (Likert 1932, Mueller 1986) and is especially useful in quantifying and comparing attitudes, since results can be standardized and contrasted (Spector 1992). This summated rating scale is one of the most frequently used tools in the social sciences (Mueller 1986, Spector 1992). Standard scoring techniques were used where the highest possible scale score was 4 for positive responses, and the lowest possible score was 1 for negative responses (Mueller 1986). Responses for negative statements were reversed prior to analysis.

An initial version of the survey was pilot-tested with the same 15 fishing families from Townsville that were involved in the scoping study. In this phase, fishers were asked to critique the survey and the scale. Surveys were left with respondents to complete in their own time and were collected the following day. The objective of the pilot study was to ensure that the questions were readable and unambiguous; that questions would elicit responses with sufficient variability to make comparisons meaningful; and that the length of the survey was reasonable. Responses were compiled and analysed and checked for skewness and kurtosis (normality). The survey was refined on the basis of the feedback and preliminary analysis, and

questions were modified as necessary. Several statements were omitted because of lack of variability in the responses, and others were omitted or modified because pilot respondents felt that "they didn't make sense", and were therefore difficult to answer.

6.3.3 Phase 3. Administration of the Survey

The final version of the survey (see appendix) was administered to 100 commercial fishers and their wives or partners (where they existed) in five coastal communities in North Queensland. Names, addresses and telephone numbers of fishers were obtained from the Queensland register of fishers maintained by the Queensland Seafood Industry Association (QSIA), formerly known as Queensland's Commercial Fishing Organisation (QCFO). All fishers and families received a letter informing them of the research and inviting them to participate. Branch chairs of QSIA in each community were also contacted and informed of the research.

Surveys were administered between September 2002 and February 2003. Survey work commenced in Cooktown, then Port Douglas, Innisfail, Bowen and Townsville, in turn. I remained within each township until as many fishers could be contacted as possible. The research was considered complete after 100 fishers had been contacted and interviewed, as this was deemed a reasonable number with which to make confident conclusions. [Hence, although 13 commercial fishers were interviewed from Townsville for the main survey, they represented only a small proportion of the township (table 6.4).] Introductory telephone calls were made to all fishing families targeted for the survey. All families that were contacted agreed to participate in the research. Appointments were made to meet with each fisher in their home. Table 6.4 presents the estimated proportion of fishers within a community that were interviewed.

Table 6.4. Sample sizes and response rates for each community (from Fenton and Marshall 2001a)

	No. interviews (sample size)	**No. local fishers in 2001**	**Likely no. in 2003****	**Sample of local industry**
Cooktown	8	15	13	61.6%
Port Douglas	23	34	35	65.7%
Innisfail	24	134	52	46.2%
Townsville	13	153	129	10.1%
Bowen	32	70	63	50.8%
TOTAL	100	406	292	34.3%

Notes: ** From the 2003 contact list

At the start of the meeting, the researcher introduced and explained the survey to the fishers and/or their partners. Instructions were provided in the same way each time. Surveys were left with each family to fill out during their own time, and were picked up the following day. In cases where fishers were unable to read the survey or provide written answers (5 instances), the survey was completed orally. Twenty fishers were out at sea for extended periods during the duration of the field study. In these instances, surveys were either faxed to the fishers at sea, or their wives or partners were able to complete the survey with the fishers during the course of a telephone call.

6.3.4 Phase 4. Qualitative Interviews

Qualitative interviews were undertaken during the same period as the quantitative surveys. The goal of this phase of the study was to gain as much information as possible on each of the conceptual variables under investigation (social resilience, resource dependency and perception of policy change) so that possible mechanisms that related the variables to each other could be identified and better understood. This information was also used to validate the results from the quantitative survey and to ensure that they were interpreted as accurately as possible.

Interviews were semi-structured in style, with open-ended questions about each of the following topics:

- Expected response to policy change
- Historical response to policy change
- Life in the fishing industry
- Interpretation of policy change
- Nature of relationship with fisheries managers
- Strength of networks with other fishers
- Strength of fishing identity
- Attachment to the community and willingness to search elsewhere for alternative income
- Other opportunities for income
- Attitude towards change
- Fishing industry's ability to manage change
- Financial circumstances/strain

- Environmental perceptions and thoughts on sustainability
- Value of fishing industry to society generally
- Any other topic that spontaneously evolved that might provide further insight into social resilience to policy change, resource dependency or the perception of policy change

Interviews usually lasted 2-3 hours and every effort was made to approach each interview in a similar way and provide similar information to each fisher about the research. One factor that was different across interviews was the presence or absence of either fisher or partner. Not all fishers were married or had a partner. Many fishers were out at sea, and since I was reluctant to introduce this potential bias into the research, I interviewed the wives or partners as representatives of the fisher. This was a reasonable thing to do because I was looking to validate the results of the quantitative survey (which was completed by the fisher) and was interested in ensuring that I could interpret results accurately. Thirty-five interviews were with the fishers only. Twenty were with the wives/partners only. The remaining 45 interviews had both fisher and partner present. The same process was used in each interview in which respondents were asked the same set of questions regardless of whom was present.

I took detailed notes during each interview. Every evening after interviews had taken place, notes were edited, modified and additions were made as part of a 'research journal'. Impressions about the fisher and their family were recorded, such as their attitudes to life and lifestyle, and their concerns and issues. General impressions about their level of social resilience in the face of policy change were also recorded for cross-referencing against analytical results later on. This research approach is an established technique (Carroll and Lee 1990).

All information provided by fishers and their families was collected in accordance with James Cook University Ethics Approval No. H1376. This permit detailed procedural requirements, including obtaining informed consent from respondents. Respondents were all well-informed, voluntary participants in the project. Participants were aware that they did not need to discuss any information that they were not prepared to divulge. All participants were fully briefed on the goals of the project and were invited to participate under their own conditions. All participants gave verbal consent for their interview to take place. Participants were assured of the confidentiality (defined as third persons not being able to identify who said what) of their

involvement and informed that data would be provided only in aggregate form in a PhD thesis format as well as in other related reports and publications.

6.3.5 Phase 5. Data Analyses

6.3.5.1 Survey Analysis

Quantitative data were analysed using standard statistical techniques and are fully described in each of the following relevant chapters (chapters 7, 8 and 9). Briefly, the main components describing social resilience, resource dependency and policy interpretation were identified using a factor analysis (principal components analysis), and the relationships between them were examined using a Pearson's correlation analysis.

6.3.5.2 Interview Analysis

Interview summaries for each of the 100 participants were constructed from the research journal. Summaries highlighted the main issues that were discussed, the response to policy change as well as notes on resource dependency and the perception of policy change. Basic demographic (e.g. age, gender, date, community, interview place and duration) and other relevant data were also recorded from each interview summary.

Content Analysis was used to analyse the data from the interview summaries. Content analysis is a powerful data reduction technique that compresses many words of text into fewer content categories on the basis of explicit rules of coding (Stemler 2001). The technique can be used to analyse the presence, meanings and relationships of words and concepts within texts and make inferences about the messages within them (Weber 1985).

In order to analyse the interviews, interviews were summarised using keywords that were established prior to the analysis ('a priori coding'). Keywords consisted of the factors comprising each of the conceptual variables (e.g. level of attachment to the occupation, interpretation of policy change etc.). Keywords were attributed to words, sentences or paragraphs within each interview summary that best described how the keywords could be interpreted. Each keyword was then described in the results section of each chapter by developing a picture of the range of meanings associated with each variable ('response to policy change', 'resource dependency' and 'perception of policy change'). Conceptual links were then made between the variables and patterns identified (Henderson 1994). Simple flow

diagrams were constructed to summarise the findings of the Contents Analysis in order to provide insight into the rather complex interactions existing between the conceptual variables.

6.4 Description of the sample of commercial fishers

The mean age of fishers in the sample of 100 fishers was 52 years old (born in 1953) (table 6.5). On average, fishers entered the industry in their early twenties, have lived within their community for 23 years and have a family member (such as a father, brother, uncle or grandfather) that also fish (table 6.5). The average fisher has completed a formal education to a year 9-10 level. About half of the fishers in the sample had completed an apprenticeship and nearly half had completed a business course. About 85% of fishers have worked outside of the industry, although only 30% believe that they could ever gain employment again in that industry if the need arose (Table 6.5).

Seventy-six percent of fishers were married. Most wives were involved in the fishing business for at least 6 hours a week, although the average was 28 hours per week (Table 6.5). Wives rarely joined their husbands out at sea. The average age of wives was 56 years old; they were educated to a year 9-10 level and few had completed a TAFE course. Around 50% of wives had an additional income. Most had worked elsewhere and were confident of being able to earn an additional income if the need arose. Wives had spent an average of 22 years in the community they currently live. Nearly half of the wives had never known their husbands to be anything other than a fisher (Table 6.5).

The average fisher was self-employed, without employees and without additional income (Table 6.5). The average fishing business turnover was around $101-150K per annum; fishers generally possessed one boat of around 10 metres in length and were unlikely to have any debt associated with the fishing business. Most fishers had one dependent. Net income for most families was less than $30,000 although the average was between $30-40,000. Most fishing families owned their own home. Most fishers targeted one seafood species on fishing trips that were typically five days long. The average fisher spends approximately 150 days out at sea each year.

Fishers generally attend at least six fishery meetings each year, know someone sitting on a Local Management Advisory Committee (LMAC), and know their industry representative

(QSIA branch chair person) "very well". Most fishers have never been on social welfare benefits (e.g. "the dole").

Table 6.5. Descriptive statistics for the sample of 100 commercial fishers

	Mean	Standard Error	n	Mode	Range
Social characteristics					
Age	52	1.13	99	59 (f)	51
Age started fishing	20.97	0.87	98	16(f)	41
No. family members that fish	1.08	0.14	99	0	6
Years in community	22.99	1.56	95	15	74
Work outside of industry (a)	1.85	.03	99	2	1
Education-highest level (i)	3.84	.15	94	4	6
Education – apprenticeship (a)	1.52	.05	99	2	1
Education – business courses (a)	1.42	.05	96	1	1
'Could you ever get work in this area again?' (a)	1.3	.05	94	1	1
With spouse or not (a) (n)	1.76	.043	100	2	2
Age of spouse	55.76	1.4	76	51	78
Education of spouse (i)	3.98	.19	75	3	6
TAFE education of spouse (a)	1.42	.06	77	1	1
Involvement of spouse in business (a) (o)	1.55	.06	77	2	1
Hours worked in the business (spouse)	27.9	4.76	32	6 (f)	99
Frequency of fishing with spouse (j)	2.35	.19	76	3	3
Spouse with alternative income (a) (p)	1.52	.06	77	2	1
Spouse ever worked elsewhere (a)	1.78	.06	51	2	1
Spouse confident of obtaining employment (a)	1.97	.13	39	2	2
Known spouse as anything else (a)	1.49	.26	75	1	1
Spouse: years lived in community	22	1.78	72	20	61
No. dependents	1.29	0.15	92	1	11
Business characteristics					
No. of family members involved in business (k)	2.19	.17	81	2	8
Employed as a skipper (a)	1.18	0.04	99	1	1
No. family in business	2.19	0.17	81	2	8
No. of people in business	3.89	0.91	81	0	64
Business turnover (b)	3.46	0.23	74	2	6
Own boat (a)	1.10	0.07	77	1	5
No. boats owned	1.67	0.11	79	1	5
Length of largest boat	11.42	0.45	78	10	20.23
Any debt remaining (a)	1.3	0.05	78	1	1
Amount debt remaining	$77K	$18K	72	0	$700K
Loan secured by home (c)	2.23	0.09	79	3	2
%Income from fishing	83.80	2.45	93	100	100
Take home income (d)	2.48	0.19	86	1	5

	Mean	Standard Error	n	Mode	Range
Own home (e)	1.72	0.08	94	1	3
Resource dependency					
No. species targeted	3.83	0.28	89	1	11
Days fished	152.72	7.77	81	150(f)	300
Average trip length	16.96	3.85	79	5	249
Perception of Policy					
Regularity of attendance at meetings (g)	2.78	.11	96	4	3
Member of an LMAC (a)	1.21	.04	95	1	1
Know someone on an LMAC? (a)	1.80	.04	96	2	1
Relationship with QSIA branch chair (h)	2.25	.07	93	3	2
Ever been on the dole (a)	1.24	.04	91	1	1

(a) 1=no, 2=yes (b) 1=$0-50K, 2= $51-100K, 3=$101-150K, 4=$151-350K, 5=$251-300K, 6=$301-350K, 7=$351K+ (c) 1=no 2=yes 3=don't have business loan (d) 1=$0-30K 2=$31-40K 3=$41-50K 4=$51-60K 5=$61-70K 6=$71K+ (e) 1=own home 2=mortgage on home 3=rent (f) Several modes exist. Smallest is shown (g) 1=0 2=1-2 per year 3=3-5 per year 4=6+ per year (h) 1=not at all, 2=a little, 3=very well (i) 1=yr7 2=yr8 3=yr9 4=yr10 5=yr11 6=yr12 7=university (j) 1=never 2=rarely 3=sometimes 4=often (k) including 'self' (m) percentage of fishers with at least one family member who fishes=66% (n) % of fishers with a wife=75% (o) % of wives involved in the business=55.8% (p) % of wives with additional income=51.9%

Chapter 7: Results I.

7

Defining Social Resilience within the Commercial Fishing Industry

"I hazard a guess that people know enough about growth to know how to nurture it – mostly. But when growth stops or collapses, they do not know enough about protection or about novelty to know how to renew confidently for the next phase of growth. And they do not know how the two – growth and novelty – interact"

C.S. Holling (2004): Foreword: the backloop to sustainability (p xv)

7.1 Introduction

How can we tell whether resource-dependent people are socially resilient to changes in government policy? It is widely accepted that institutional change can affect the resilience of resource-dependent communities (e.g. Smith 1995, Lane and MacDonald 2002, Smith et al. 2003, Allison and Hobbs 2004), but few studies have directly assessed and quantified its effect, especially in the context of resilience. This study was designed to define, quantify and interpret the likely response of commercial fishers to changes in fisheries policy in terms of their ability to cope and adapt.

A conceptual model of social resilience for a resource-dependent industry such as the commercial fishing industry was developed in the first part of this thesis. Resilience was conceptualised as comprising a point of 'precariousness' within a system bounded by 'thresholds' where multiple trajectories are possible in response to a change-event disturbing the system. These trajectories depend on the dimensions of the valley latitude and depth. They represent the 'adaptability' of the system and to some extent, the 'transformability' of the system (Holling 2004, Trosper 2003b, Walker et al. 2004).

In order to operationalise the model, it was proposed that measures of well-being could assess precariousness and desirability of the system; measures of the desirability of the regime could

assess thresholds; and measures of flexibility could assess the adaptability of the system (which describes the possible trajectories that can be taken). Measures of learning, creativity and flexibility were also considered to be important in assessing adaptability (Carpenter et al. 2001, Folke et al. 2002c).

Individual well-being was identified in chapter 2 as being the best variable with which to begin measuring social resilience since it can identify the current level of precariousness of the system as well as identify the proximity to the thresholds within the system. An important qualifier to defining social resilience within this context was that it may be possible to remain within the fishing industry after a policy change and be unresilient: a fisher might remain within the fishing industry not because they are demonstrating an ability to cope and adapt, but because they lack other employment opportunities: these fishers are "socio-ecologically unresilient". They have a low level of well-being and have entered into an 'undesirable' state even though they appear to maintaining their structure and function within the industry.

In this chapter, the level of well-being of commercial fishers to generic changes in fisheries policy was measured using standard survey techniques. Survey questions were posed that also measured how close fishers thought they were to their thresholds of coping as compared to other fishing families and their level of financial and other stress within the family. The level of flexibility and feelings of empowerment were measured using survey questions that assessed other career options and their confidence to incorporate policy change into their lives.

The purpose of this chapter is to present the results of the survey questions in a form that could progress our understanding of social resilience to policy change. The results of the survey were expected to refine the model of social resilience developed in chapter 2. Survey questions were presented to 100 commercial fishers in five communities in North Queensland.

7.2 Methods

In order to measure 'response to change', a list of 17 statements about expected and historic response to change was generated on the basis of the literature and scoping study. The survey statements attempted to measure the level of well-being of commercial fishers, including their confidence and concerns in coping and adapting to changes in fisheries policy. Fishers were

asked to self-assess their expected level of well-being in terms of acceptability, flexibility, other opportunities and willingness to be creative and novel in their approach to adapting to the requirements of policy change. A scoping study was used to ensure that the scales were as representative of the constructs, as possible. A list of items was pre-tested as part of the pilot study. Data were checked for skewness and kurtosis (normality) and questions were modified or omitted as necessary. The final 17 statements were then included as part of a broader survey that also attempted to examine the influence of other factors (such as resource dependency and policy perception) on social resilience, as described in the previous chapter (see appendix). Respondents were asked to rate their attitude to each statement using a 4-point Likert scale.

Only those statements that contributed to the internal consistency of the scale for social resilience, as described by a reliability analysis, were included (Carmines and Zeller 1979, Zeller and Carmines 1980, Spector 1992). A reliability analysis is based on a calculation of the correlation amongst statements using Cronbach's alpha (Chen and Popovich 2002). A Cronbach's alpha of 0.7 or greater was accepted as indicating a reliable scale (Nunnally 1978). Results for the reliability analysis and the statistics describing the response to policy are presented as in Sutton and Ditton (2001).

In order to identify the underlying variables comprising social resilience, a Principal Components Analysis (PCA) was used on the statements comprising the scale for social resilience (Kim and Mueller 1978). A PCA is a statistical technique used to discover which statements form subsets that are relatively independent of one another. Statements that are correlated with one another but are largely independent of other responses are combined into factors (Zeller and Carmines 1980, Tabachnick and Fidell 1996). A PCA is based on the assumption that some underlying factors, which are smaller in number than the original number of statements, are responsible for the co-variation among the responses (Kim and Mueller 1978). In this study, the data are rotated using an orthogonal rotation (varimax), which simplifies the factor structure by maximizing the variance of a column in the pattern matrix (Kim and Mueller 1978).

An important step in analysing the results of a PCA was to ensure that each component identified was interpreted or 'labelled' as accurately as possible. This was important in order to accurately interpret the response of fishers to changes in policy. Each component was labelled on the basis of the statements comprising it. The validity of each interpretation was tested by

correlating the factor scores with other similar statements in the survey that were not included as a measure of social resilience. A Pearson's Correlation was used to test the significance of correlations. An alpha level of 0.05 was used as the minimum level to assess the significance of each relationship (Underwood 1997). This technique provides some information about the level of association between a label and a meaning.

The validity of each interpretation was further examined using qualitative data techniques. The collection of qualitative data was described in the previous chapter (chapter 6). Briefly, interview summaries for each of the 100 participants were constructed from the research journal, within which notes were taken during the semi-structured qualitative interviews. A Content Analysis was used to analyse the data from the interview summaries (Weber 1985, Stemler 2001). 'A priori' keywords such as 'risk', 'confidence', 'planning', 'coping', and 'interest' were used, although several other keywords were also used to represent the meaning of each sentence, quotation or paragraph as necessary. In order to develop a picture of the range of responses to changes in fisheries policy, and to describe how the quantitative results might be interpreted, qualitative results were formed on the basis of the meanings associated with each keyword. Content Analysis typically involves a frequency count of each keyword (Weber 1985), however because quantitative analyses have already identified patterns within the dataset, frequency counts were deemed unnecessary for the qualitative results. I attempted to provide a picture that portrayed how the quantitative results could be explained, whilst also providing examples to illustrate the range of responses of fishers to policy change.

7.3 Results

7.3.1 Defining Social Resilience

Table 7.1 presents the descriptive statistics and the results of the reliability analysis for each of the 17 survey statements used. Table 7.1 also shows that of the 17 statements used in the survey, only 12 reliably contributed to the scale. These 12 statements formed the basis of the measure for social resilience in this study.

Table 7.1. Descriptive statistics and reliability analysis for 'social resilience'.

Survey items	Mean **	SD	Item-total correlation	α if item deleted
Social resilience (a=.689)(a with five items deleted=.701)				
I am confident that I could get work elsewhere if I needed to	1.98	1.06	.46	.653
I would be nervous trying something else*	1.89	.97	.45	.656
I am more likely to adapt to change compared to other fishers I know	2.68	.90	.47	.656
I am confident things will turn out well regardless of changes	2.09	1.08	.43	.656
I have many career options available to me if I decide to no longer be a fisher	1.66	.91	.41	.662
Every time there is a new change I plan a way to make it work for me	2.86	.94	.68	.666
If there are any more changes I will not survive much longer*	2.18	1.00	.32	.670
I can cope with small changes in industry	3.01	.85	-.05	.676
I am too young to retire and too old to find work elsewhere*	1.66	.88	.23	.680
I have planned for my financial security	3.06	.98	.20	.684
I am not competitive enough to survive much longer*	2.86	1.15	.13	.684
I am interested in learning new skills outside of the industry	2.32	1.1	.17	.685
I would find it very difficult working for someone else***	1.89	1.02	.56	.685
Change is normal part of our everyday life***	2.85	.84	.28	.686
I would like to start up a business one day doing something other than fishing***	1.97	.95	.30	.693
I believe that the future will look after itself***	1.64	.85	.02	.700
I am always thinking of new and better ways to improve my fishing business***	2.97	.94	.27	.706

Notes: * The data for negative worded statements were reversed prior to analysis

** Statements were measured on a 4-point scale ranging from 1=strongly disagree, 2=disagree, 3=agree to 4=strongly agree

*** The five statements that were removed from the scale were those with the largest Cronbach's alpha if deleted

The Principal Components Analysis revealed that the responses of fishers to the statements to assess social resilience were best described by four components. These components represented 60.1% of the variance (table 7.2).

Table 7.2. Principal Components Matrix of the responses of commercial fishers to policy change.

Variance explained = 60.1%	**PC 1 23.4%**	**PC 2 18.6%**	**PC 3 9.6%**	**PC 4 8.5%**
I have many options available other than being a fisher	.808	.	.	.
I am confident that I could get work elsewhere if I needed to	.787	.	.	.
I am too young to retire and too old to find work elsewhere*	.625	.	.	.
I would be nervous trying something else*	.603	.	.	.
I can cope with small changes in industry	-.462	.	.	.
I have planned for my financial security	.	.858	.	.
Every time there is a new change I plan a way to make it work	.	.746	.	.
I am more likely to adapt to change compared to other fishers	.	.628	.	.
I am not competitive enough to survive much longer*	.	.	.682	.
I am confident things will turn out well regardless of changes	.	.	.637	.
If there are any more changes I will not survive much longer*	.	.	.547	.
I am interested in learning new skills outside of the industry	.	.	.	.936

Notes: PC= Principal component

(.) Factor loading scores less than 0.45 are not displayed

* The data for negative worded statements were reversed prior to analysis

The first component, representing 23.4% of the variance in the data, consisted of statements relating to the level of risk associated with absorbing and adapting to change. The statements included, "I have many career options available if I decide to no longer be a fisher", "I am confident that I could get work elsewhere if I needed to", "I am too young to retire and too old to find work elsewhere", "I would be nervous trying something else" and, "I can cope with small changes in the industry". (Negative statements were reversed for analysis). These statements made reference to the ability to secure work elsewhere if the need arose, as well as the ability to cope with small changes within the industry.

The second component, representing 18.6% of the variance, consisted of statements relating to the ability to plan, learn and reorganise. These statements included, "I have planned for my financial security", "Every time there is a new change I plan a way to make it work for me" and, "I am more likely to adapt to change compared to other fishers that I know".

The third component, representing 9.6% of the variance, consisted of statements relating to the ability to cope with change – or the rate at which thresholds of coping are reached. The statements included, "I do not think I am competitive enough to survive much change", "I am confident things will turn out well for me regardless of changes" and, "if there are any more changes I will not survive much longer".

The fourth and final component, representing 8.5% of the variance, consisted of the single statement, 'I am interested in learning new skills outside of the industry'. This statement reflects the ability of fishers to adapt to change by 'reinventing' themselves. This component is interpreted as the level of interest in change.

Figure 7.1 illustrates a summary of the response of fishers to generic changes in policy. It shows that the response of fishers is likely to involve (i) an assessment of risk in approaching change (ii) planning, learning and reorganising (iii) an assessment of the proximity to the threshold of coping, and (iv) an interest in change. The percentage of the variance of the data explained by each component is also represented. Variance represents, for most purposes, the uncertainty associated with the patterns identified (Underwood 1997).

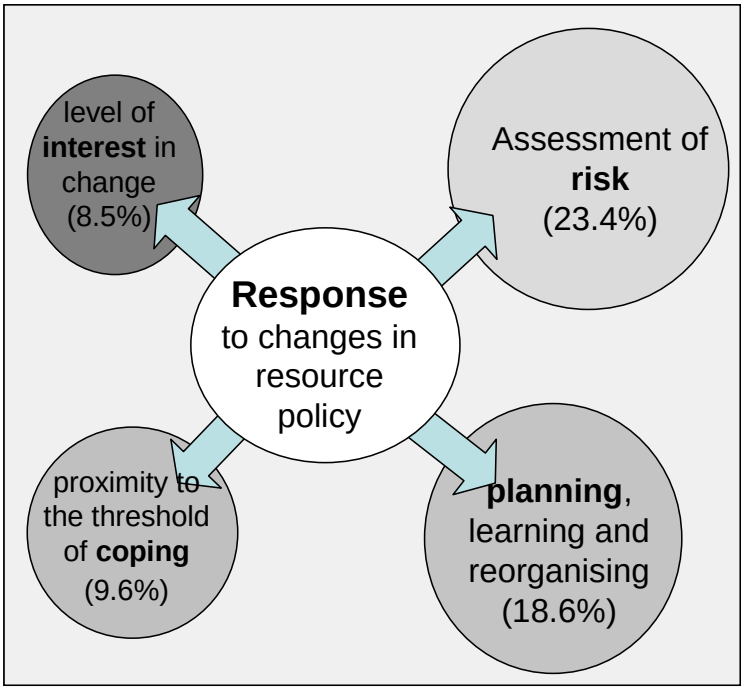


Figure 7.1. The components of the response of commercial fishers to changes in fisheries policy. The percentage of the variance of the data explained is also shown.

7.3.2 Validity and interpretation of the Interpretation

7.3.2.1 Correlations with other similar statements

The response of commercial fishers to generic changes in policy was interpreted to consist of i) an assessment of risk in approaching change ii) an extent of planning, learning and reorganising iii) an assessment of the proximity to the threshold of coping, and iv) a level of

interest in change. These interpretations were significantly correlated with other related statements in the survey that were used to assess other related factors such as resource dependency (Table 7.3).

A Pearson Correlation showed that component 1, interpreted as 'the assessment of risk in approaching change' was significantly correlated with two other statements in the survey also describing an assessment of the future. One statement was: "I am confident that my fishing skills will mean that I am always successful in the fishing industry". The other was: 'Our business skills would be useful in setting up a business other than fishing'. Both statements describe the level of confidence fishers have in approaching generic change in fisheries policy.

Component 2, interpreted as 'the level of planning, learning and reorganising', was significantly correlated with statements elsewhere in the survey describing a strategic approach to change (Table 3). These statements were: 'I do not mind going into debt if I can get ahead as a result', and 'We have a detailed business plan for the following year.'

Component 3, interpreted as, 'the proximity to the threshold of coping' was significantly correlated with the amount of fishing income earned each year (Table 3).

Component 4 was interpreted as, 'the level of interest in change'. It was significantly correlated with other statements in the survey also describing the level of interest or likelihood of changing career: 'I am a fisherman. I cannot think of any other job that I would rather do", and "fishing is my lifestyle – it is not just my job."

Table 7.3. Pearson Correlation Matrix between (i) related items in the survey that were not used to assess social resilience directly, but could validate social resilience, and (ii) each of the factor scores for the four components of social resilience identified in this study.

Related items in the survey	**Pearson Correlation**
Response to change 1: Assessment of risk	
"I am confident that my skills will mean that I am successful in the industry".	-.214(*)
'I think I could get a job in this area again" [trade]	.605(**)
Response to change 2: Planning, learning and re-organising	
'I do not mind going into debt if I can get ahead as a result'	.437(**)
'We have a detailed business plan for the following year.'	.330(**)
Response to change 3: Proximity to the threshold of coping	
Income from fishing	.247(*)
Response to change 4: Level of interest in change	
'Fishing is my lifestyle – it is not just my job'	.227(*)

Notes: (*) Correlation is significant at the 0.05 level (2-tailed).
(**) Correlation is significant at the 0.01 level (2-tailed).

7.3.2.2 Qualitative results

In this section, I present evidence from the qualitative data to confirm or deny the quantitative results that suggest that the response of commercial fishers to policy changes consists of the four main factors: the assessment of risk, planning, learning and reorganising, the proximity to thresholds and the level of interest in change.

a. The assessment of risk in approaching change

Qualitative data suggested that the most important component of the response of commercial fishers to policy change is the assessment of risk. Qualitative results suggested that many fishers worried about the implications of policy change in their lives, and focused especially on the financial costs of change. Many fishers were worried that, in order to incorporate the change into their working lives, financial resources would have to be accessed, putting strain on their ability to be competitive and viable within the industry. Some fishers believed that they did not have the resources to incorporate any further change into their current activities. Fishers explained that a seasonal or permanent closure to their current fishing grounds would

mean that they would have to travel further, incur greater fuel costs and have less time fishing. A restriction in quota would mean a significant reduction in income.

Fishers also discussed risk in terms of the confidence that they had to secure income elsewhere. Nineteen of the 100 fishers surveyed felt positive about obtaining income elsewhere either through a different job, setting up a new business, or through existing investments or other businesses. For example, some fishers owned a cattle ranch, a sugar cane farm or a small business in the local community (eg. a newsagency store) in addition to their fishing business. Most fishers, however, were less confident in their ability to access another income source. Twenty-six fishers believed that their age was a limiting factor in obtaining a job elsewhere, and eight others believed that retiring was their only option. Four fishers believed that they would need to apply for the pension or access unemployment benefits, "even though (they) hate dole bludgers".

Wives and partners also described the risk associated with policy change in terms of the ability to secure alternative employment elsewhere. Generally, wives confirmed their husbands' assessment. Wives were acutely aware of the low probability that their husbands would be able to secure work elsewhere if the need arose. For example, one wife said that, "no one in their right mind would ever employ my husband – he was meant to be a fisher, and he would be useless at anything else". Another wife explained how her husband is illiterate and extremely anti-social. He hated school. He spent his first days at school underneath the school building, and "stared out at the world from between the slats, and more or less refused to come out". She says that this puts him in a very special case as to why he should be allowed to continue fishing: "..because he genuinely does not have any other option available to him. He can fish really well – and he can support the family on this income". Another wife who was already working in two jobs said that if the proposed management plan for the line fishing industry goes through in its current form, she would have to increase the hours that she works even more so that she can support her husband and family, because she did not think that her husband would be able to secure alternative income. These women were concerned about the risk associated with policy change.

Risk was assessed broadly. Whilst some fishers believed that they could be 'better-off' as a result of policy change since "the competition would be removed", the implications for fishers at the other end of the scale were especially severe. One fisherman's wife explained that the family was slowly recovering from the release of a proposed policy change (the draft

management plan for the line fishing industry: the 'Line Plan') in which they were told that they would only have 23 days to go fishing each year. The wife said her husband became suicidal. "He couldn't do anything at all; he became miserably depressed, and unable to operate, even doing the simplest things". She didn't know what to do, and refused to leave his side. It took him about 2 months to "get hold of himself", and only now (4 months later) is he able to resume fishing.

These examples support the quantitative findings that the level of risk associated with change is an important step in the way fishers respond to policy change. Fishers immediately interpret the implications of policy change in terms of its financial impact on their family, their ability to absorb the cost and their ability to secure alternative employment if the need arose. Whilst some fishers were confident that they would be able to cope with and adapt to a change, others assessed the cost of change as being too difficult to survive either within the industry or outside of it.

b. The ability to plan, learn and re-organise

Commercial fishers generally approach their fishing business either as a lifestyle or as a generator of income. Thirteen fishers, out of the 100 surveyed, viewed their business primarily as a means to make money. These people tended to actively pursue multiple avenues directed toward maximising the profitability and sustainability of their business. These fishers were strategic, tended to plan for the future and possess business skills that were developed through formal business courses. As a result, business-oriented fishers were better at planning for change. One family, for example, was looking at expanding their fishing grounds as far away as Papua New Guinea in order to maximise profits and ensure the sustainability of their business. Others talked about the importance of keeping up-to date with paperwork, and maintaining fishing vessels and gear as a proactive strategy to minimise risk of "downtime" from mechanical problems. Other fishers talked about upgrading their license by borrowing money to purchase more fishing quota from elsewhere. Some fishers were actively involved in local management advisory committees (LMACS) because they thought that they would be more competitive within the industry as a result. Others had planned to absorb the financial costs of policy change by using "emergency funds". One fisher said that he planned to buy a bigger boat if he was excluded from his current fishing grounds and had to travel further each day. Fourteen fishers believed that regardless of the change that was introduced, they would make every effort to ensure that they continued as fishers. These people made comments such

as "I will make sure that I am one of the survivors" and "I will continue fishing, no matter what!".

Although most of these fishers discussed how they would be able to adjust to most changes within the industry, many business-oriented fishers also discussed their plans to leave the industry if conditions became too difficult. For example, some families had plans to sell their fishing business and buy another small business within the township if necessary. One fisher said, "I could do something like buy a nightclub" (with which he has had prior experience). Another family already had a viable 'pie shop' that they were planning on making as their primary income earner in the next few years. Another family planned to go into business with their brother and sister-in-law in the event that conditions within the fishing industry became too difficult.

In contrast, monetary gains were secondary benefits for the many commercial fishers that approached fishing primarily as a lifestyle. Some fishers made comments such as, "I wouldn't swap my life for anything", "fish oil is thicker than blood", or "I was born to be a fisher". These fishers were very passionate about their occupation and keenly tried to describe how important it was for them to be allowed to continue fishing. One fisher explained how he entered the industry a little later than everyone else, but entered it because he "always, always wanted to fish professionally". These fishers did not have contingencies plans to put into place in the event of policy change affecting their lives, believing that, somehow, "all will turn out alright". Lifestyle fishers made comments such as, "I hope that the outcome will not be too bad" or, "I have no idea what I can do". Other fishers explained that, "fishing is the only thing I have ever done" and were at a loss to describe what they would do if they were no longer able to fish as they always had. For many lifestyle fishers, the inability to plan and reorganise was confounded by the fact that they did not have the energy to start again elsewhere. Eighteen fishers thought that they would remain within the fishing industry, regardless of what institutional change was introduced, not because they were especially skilled, but because the idea of re-organising was 'exhausting'. These people made comments such as, "it has been a real struggle to get my Masters" and, "I couldn't bear to have to start again".

Other fishers described how they had been lifestyle fishers in the past, but were forced to transform into more "professional" fishers as the result of past institutional change. These fishers had learned how to plan and reorganise. One family in particular described how they

only ever took each day, "one at a time", and now they needed to plan and be aware of changes and requirements within the industry. The introduction of compulsory logbooks (introduced in 1987 for line and net fishers) has had a major influence. Every day, fishers are required to document where they had been fishing and what they had caught. Keeping records through the logbook system has forced many of the 'lifestyle' fishers to be aware of their business activities and transactions, and this has seemingly changed the 'nature' of their approach to their fishing activities. Many fishers described how, once, fishing meant doing what you wanted to do each day, without concern for record keeping. For some families, the requirement to maintain fishing records has fallen upon the women in the business, because some fishers have been unable to reorganise in response to past policy change. As one fisher explained, "if it wasn't for my wife, I would have no hope of complying with the [logbook] regulations". Nonetheless, these people demonstrate that it is possible for lifestyle fishers to transform within the industry and learn the necessary skills to be competitive and survive.

In summary, fishers with a lifestyle approach to fishing are less likely to be able to incorporate the requirements of policy change into their lives because they lack the ability to plan, learn and reorganise. Lifestyle fishers are more likely to believe that, regardless of the specifics of the policy change that might be introduced, they will somehow remain within the industry. Business-oriented fishers, in contrast, had plans to ensure that they would remain competitive within the industry or had plans to continue their current standard of living outside of the industry. Hence qualitative results support the quantitative findings of the study. Planning, learning and reorganising is an important step in the response of fishers to policy change determining their ability to cope and adapt.

c. Threshold of coping

The proximity of fishers and their families to their threshold of coping was discussed in financial, emotional and psychological terms. Most fishers perceived that policy change would have a financial impact of some degree. Whilst some fishers described their ability to absorb some financial cost, others described how close they were to financial collapse. For example, one fisher explained, "I am 55; my wife is 53. Our family home was sold in 1991 to pay off our share of the boat and license, and we have rented a house from that time. It has been a real struggle. With the current line plan we would have a license worth nothing and a boat that would be very hard to sell". Another fisher explained that, "you have to have at least $20,000 in your account at any one time to pay for things that go wrong like a mechanical breakdown,

or to pay your bills even if the fishing is lousy. Surprises occur regularly, and can really influence what sort of year you have." One wrote on their survey how, "we have planned for our financial security- but government planning and legislation is continually eroding our ability to maintain financial security for the future." One fisher explained that, "you need extra cash to compete with the bigger businesses that will definitely be around in the future. I am worried that the banks will not support me here, and that I will be forced to remain as I am [a small-scale fisher] and not able to move with the times." These fishers were worried that the financial costs of incorporating the requirements of policy change into their lives would mean that they would be less competitive within the industry, and would struggle to remain as one of the survivors.

Twenty-one fishers thought that whilst other fishers would be forced out of the industry as the result of policy change, they would remain within the industry because they were skilful and competent as fishers, and would therefore incur only minimal financial cost. These fishers believed that they would be better able to cope with the requirements of policy change compared to other commercial fishing families. However, five other fishers explained that those fishers that would be at a competitive advantage in the event of policy change were "better-of" financially, and could afford bigger and better equipment. They believed that fishers that were not able to afford bigger and better equipment would reach their thresholds of coping more quickly.

Many fishing families also explained that a change in policy might be difficult to cope with emotionally, as well as financially. Several families had already endured previous policy changes which has 'tested' their ability to cope. One wife explained that the recent trawl plan had financially set them back about ten years which they felt enormously resentful about. She felt that they could not endure another set-back – for emotional reasons as much as for financial reasons. Another wife described the impact of the trawl plan as, 'having lost their dream'. She described how hard they had worked to buy a trawler, and how devastating it was to learn that they were severely limited by the new plan. Their dreams of being self-employed trawlers, she said, were over: "the consequences of losing your dreams in a [personal] relationship are potentially catastrophic", she warned. Although they were still together as a family, they have had countless arguments about their future, sleepless nights and their relationship seems to have (for the moment) "lost direction". In this way, the financial strain that many families might have to endure as the result of institutional change, could affect the

ability of a family to cope and remain together. The level of marital stress within a relationship could determine the proximity of commercial fishers to their threshold of coping.

Psychologically, some fishers lacked the confidence that they could transform in response to policy change. Fishers that lacked self-confidence explained that they would be unlikely to cope with further policy change. Some fishers described how, in the past, they had left the industry because they believed that the fishing industry no longer offered security. Yet, they were forced to return because they were unable to secure income elsewhere. One fisher explained how he had tried to obtain a job as a driver. The interviewer said that he would employ anyone, "except a commercial fisher". Reluctantly, he realised that his only opportunity to make money was to remain within the industry and work for other fishers. In another example, a fisher had left the fishing industry to become a house painter. He thought he might be able to make the same sort of income as he had earned in the fishing industry. He lamented, however, that it was not possible to obtain work with an equivalent income to the fishing industry, without specific skills. In another example, a 55 year old man decided to leave the fishing industry and return to boiler-making: the trade that he had learned 40 years earlier. When he applied for a job he realised how far the boiler-making trade had come. He said, "it was ridiculous to think I even had any idea of what was going on – I didn't even recognise some of the tools they were using!" He says that he has tried "really, really hard" to find a job – any job – but nobody wants to employ him at his age. Many fishers have also tried applying for the dole to assist them in their search for alternative income outside of the industry; however, because of the assets that many fishers have collected over the years, many fishers found that they were ineligible. The psychological condition of many of these fishers, namely their lack of confidence in their abilities or their options, suggested that the prospect of future policy change would threaten their ability to cope.

These examples describe the importance of the financial, emotional and psychological state of individuals in approaching change. These factors can determine the proximity of fishers to their threshold of coping. These results support the quantitative findings suggesting that the perception of the proximity to the threshold of coping is an important component of the response of fishers to policy change.

d. The level of interest in approaching change

Qualitative results suggested that the level of interest in adapting to the requirements of policy change and learning new skills was influenced by a fisher's level of flexibility. Some fishers had an inflexible attitude. For example, one fisher explained that, "even if someone offered me a fantastically paid job, I would never take it". Some fishers were inflexible because of their family circumstances. For example, six fishers explained that even if they could fish or obtain work elsewhere, they were not willing to move from their community because it would mean leaving behind their family or grandchildren. This was especially true for fishers who were divorcees whose children were living in the same community. Some fishers were inflexible because of financial reasons which meant that they were not able to absorb the costs of change. One trawl family explained, "because we are both in our 50s, getting a job is very difficult. We do not have enough money to retire and after a lifetime of employment, ending up on the dole is very demeaning."

In contrast, some fishers were interested in learning new skills within the industry in order to remain fishing, or in living and working elsewhere, especially if conditions within the industry became more difficult. Several fishers discussed that they could easily diversify within the industry or were interested in learning new skills outside of the industry. For instance, some fishers with multiple endorsements on their fishing licence made comments such as, "if the line plan goes through, then I can learn to go crabbing". Another fisher explained that his cattle ranch 'out west' was doing quite well, and that if proposed policy changes were to eventuate, he would not mind becoming a full-time farmer.

These examples describe the importance of flexibility in determining the interest that a fisher has in learning new skills and adapting to policy change. Fishers could show a lack of interest in learning new skills because of their attitude, their age, their current skill level, or their strong family ties in the area which prevented them from moving elsewhere. Fishers that had other income opportunities (e.g. multiple endorsements or outside of the industry) were more interested in change.

7.4 Discussion

As Carpenter and Brock (2004) predicted, 'many indicators, in many dimensions, are necessary to adequately represent resilience.' The results of this study suggest that individual resilience is

best described by four principal components. The resilience of fishers and their families is influenced by their assessment of risk, their strategic tendencies, their distance from their thresholds of coping and their interest in change. These four characteristics can explain the variance within this study with over 60% reliability. This model provides a standardised framework for describing and quantifying 'social resilience', at least for resource industries similar to the fishing industry in North Queensland (see figure 7.2). Figure 7.2 illustrates how an operational model of social resilience to policy change for the commercial fishing industry might be visualised. Figure 7.2 illustrates how the four components of social resilience identified within this study can be used to determine the position of 'precariousness' within a stability landscape and the proximity of thresholds. Thresholds were identified in this study on the basis of the qualitative results: a factor representing well-being on the basis of financial, emotional and marital stress as well as skill level and potential skill level. If applied and developed in future studies, this operational understanding may facilitate comparisons within and between different studies of resource-dependent communities, and to vastly different forms of institutional change. Most importantly, this operational model of social resilience can be used to progress our understanding of how resource-dependent people respond to changes in resource policy and adapt.

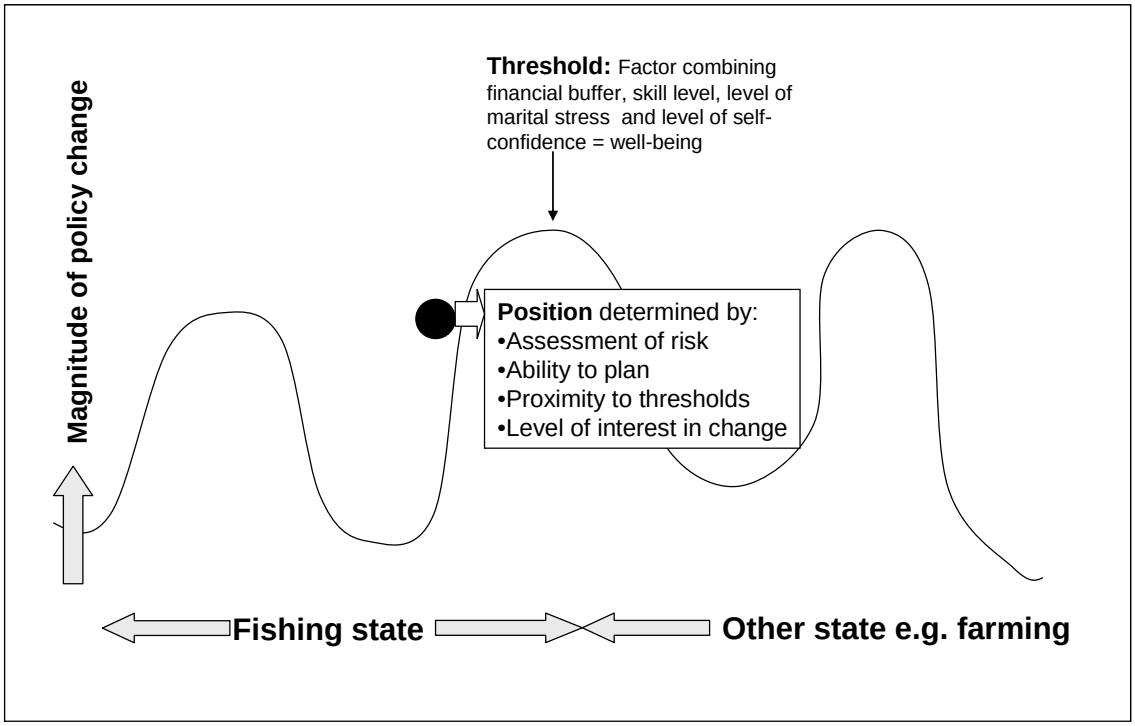


Figure 7.2. An operational understanding of social resilience to policy change within the commercial fishing industry

An important tenet of this thesis was the importance of the assessment of the 'desirability' of the end state or domain of attraction. Without this knowledge, it is not possible to accurately assess social resilience. It was argued (in chapter 2) that this assessment, for the purposes of this study, had to be a self-assessment since fishers could remain within the fishing industry after an institutional change not because they were demonstrating resilient qualities, but because they did not have other options. Only a self-assessment of well-being could differentiate between those fishers that remained with the industry because of their capacity to be resilient as opposed to those who remain because they have no other option. A fisher with high resilience may remain within the fishing industry after an institutional change because they (i) assess that they can manage the risks and remain within the industry (ii) are confident that they have the skills and ability to incorporate the requirements of the change and reorganise themselves within the industry, (iii) are far from their threshold of coping and can experiment with their options within the industry or (iv) have an interest in remaining within the industry but have the flexibility to leave if the need arose. Results also suggest that a fisher who has high resilience can leave the industry as the result of institutional change in order to maintain their level of well-being since they either (i) assess that the level of risk in leaving the industry is less than remaining within it, (ii) are confident that they have the skills and ability to ensure a successful transition and can reorganise, (iii) are far from their threshold of coping and can experiment with their options for the future or (iv) have an interest in leaving the industry and have the financial and familial flexibility to access other options.

Three of the components identified in this study match the three defining attributes of resilience within socio-ecological systems as identified by others working in the sustainability sciences (Holling 1973, Carpenter and Gunderson 2001, Scheffer et al. 2001, Walker et al. 2004). The first defining attribute of resilience is the amount of disturbance a system can absorb and still remain within the same valley or basin (Holling 1996, Ludwig et al. 1997, Bellamy et al. 2001, Walker et al. 2002). This requirement is met by the third principal component of social resilience identified in this study: the proximity to the thresholds of coping. Thresholds are used to describe when a system (or individual) has passed from a desirable basin or 'domain of attraction' to another. Thresholds can be reached gradually or rapidly (Walker and Meyers 2004). In this study, thresholds of coping are described by financial and psychological factors. The proximity to these thresholds was determined by asking fishers to evaluate the level of stress in their personal situation. Results suggest that fishers with a financial buffer are less likely to experience emotional strain and the family is

more likely to be able to cope with the requirements of change. Fishers who believe that they have other options other than remaining within the industry, or are confident in their ability to be competitive as a fisher, are also more likely to be able to cope with institutional change. Much research has concentrated on the psychological effects of stress and change (e.g. (Saegert and Winkel 1990, Milbrath 1995, Biscoe 2002). Other researchers have found that people living and working in resource-dependent communities can suffer from severe stress and emotional trauma as a result of institutional change (Smith 1995, Sonn and Fisher 1998, Smith et al. 2003, Bradley and Grainger 2004). For example, Smith et al. (2003) examined the mental health of commercial fishers after the Florida Net Ban. They described the impacts of the policy change in terms of perceived stress, depression, anxiety and anger. Stress – regardless of the way it manifests itself – but as measured by those experiencing the event, can thus be a significant response to policy change and can determine the proximity to the thresholds of coping.

The second defining attribute in the general theory of resilience (Holling 1973, 1986) is the degree to which the system is capable of 'self-organisation'. This corresponds to the fourth principal component identified in this study: the level of interest in change, or flexibility. Several researchers discuss the importance of economic and social flexibility in the maintenance of resilience, and how flexibility can enable an individual or system to be resilient (Gunderson 1999, Shindler and Cheek 1999, Carpenter and Gunderson 2001). Loss of social flexibility at a community level can mean the gradual loss of social and human capital through the erosion of organizational networks and skills. At an individual level, it refers to the inability to take advantage of other options within the community and the need to address practical and attitudinal constraints relating to family and financial commitments, and a lack of transferable skills. In a psycho-sociological sense, loss of flexibility can refer to the attitudes and coping strategies that are potentially maladaptive under future scenarios (Gramling and Freudenberg 1992). Further psycho-sociological research may further develop our understanding of the role of individual flexibility in coping and adapting to policy change, and at broader levels. (The influence of social networks on influencing social resilience is investigated in chapter 9).

The third defining attribute - the ability to learn and reorganise - corresponds with the second principal component in this study: the ability to plan, learn and reorganise. In this study, it was apparent that some fishers are better able to plan for and adapt to change than others. Fishers with a stronger business approach tended to show these attributes compared to fishers that

had a lifestyle approach. This dimension of social resilience has also received attention in the literature, although mostly at a larger scale such as the community, organisational and systemic level (Carpenter et al. 2001, Folke et al. 2001, Hiedanpaa 2005), and also in isolation of other dimensions. Researchers have found that adaptation processes do not occur unless people use novelty, creativity, experimentation, learning and planning in approaching change (Olsson et al. 2004, Folke et al. 2005, Hiedanpaa 2005). Harris et al. (1998), for example, studied 387 timber-dependent communities in the interior Columbia Basin (Pacific Northwest). They found that communities that were more likely to be resilient possessed characteristics that reflected their ability to plan and re-organise and had a greater 'preparedness for the future'. They found that resilient communities had active social groups and civic organisations; sound educational infrastructure; availability of services and success in obtaining development grants. Results from this research suggest that these qualities can predict resilience also at an individual level and within the commercial fishing industry, but only to a certain extent: other components are also influential. For example, this study found that individuals that can visualise the requirements of the future, can read important feedback information, can learn and act, are more likely to be able to cope with change and adapt.

Thus, this study has found that social resilience, like socio-ecological resilience (Vayda and McCay 1975, McCay 1978, 1981) and ecological resilience (Ludwig et al. 1997), consists of at least the following elements: the distance from the thresholds of coping, the ability to self-organise through being flexible, and the ability to learn and adapt. To a large extent, many of these concepts overlap in their meanings and descriptions. For example, qualitative results from this study showed that the level of confidence that people had in approaching change was an important factor determining the ability of people to plan and reorganise, as well as determine the proximity of people to their thresholds of coping.

The assessment of risk in approaching change is a unique dimension identified through this study. Results suggest that the way in which fishers assess risk is the main influence of their response to policy change. However, this assessment has not previously been used as a predictor or descriptor of social resilience. This may be because social resilience is mostly described through post-hoc analyses of responses to disturbance (Berkes and Jolly 2001), whereas this study looked at resilience prior to a policy change event occurring. This study showed that the assessment of risk that people make in approaching change is of fundamental importance in describing the likely resilience to future change. Gramling and Freudenberg (1992) in their study of resource-dependent people also found that resource-users will initially

assess the opportunities and threats associated with a proposed change, even before the actual event takes place. Their research has been based mostly on mining- and timber-dependent communities and has established that the perception of change can significantly affect the way in which people initially cope or respond in the short-term. Results from the current study have also shown that fishers also perceive the risk associated with proposed changes in terms of opportunities and threats, and that these perceptions can also affect their long-term ability to cope: their ability to adapt and be resilient. These observations suggest that the assessment of risk, as identified in this study, is also related to the level of confidence that resource-users might have in themselves and in the future. Fishers that are confident that they are able to incorporate the requirements of change into their lives are more likely to assess the risk associated with policy change more positively.

A common theme unifying each of the dimensions of resilience identified in this study is confidence. Confidence is a quality that determines the level of self-belief and self-reliance that a person has in approaching change. It provides an indication of the level of self-assurance arising from an appreciation of one's abilities. The erosion of confidence as a result of a change in resource policy can affect the decisions that people make about the future, and the ways in which they are made, and this in turn can alter a person's view of themselves and affect their ability to cope with change and adapt (Gramling and Freudenberg 1992, Freudenberg and Gramling 1992). This dimension to social resilience is a uniquely social construct that it has not been identified for ecological or socio-ecological systems. Nonetheless, it may provide paramount understanding in the development of management strategies designed to maintain resilience of socio-ecological systems. Empowering people to have control over the direction of their own lives, for example, may be a simple strategy to manage resilience and deal with several components at once.

7.4.1 Analysis and revision of the conceptual model

This study has attempted to contribute to our understanding of social resilience within a natural resource management context. This study represents an early attempt to define social resilience by consolidating and developing the work of others and testing simple concepts. Results are more complex than initially expected. The concept of well-being initially introduced in the conceptual model remains an important characteristic of resilience. However, as a 'stand alone' variable, it is not adequate to capture the complexity and multidimensional nature of social resilience. People can report a high level of well-being, but

have low resilience. For example, they may be naïve as to the effects of policy change, lack concern about the future or inaccurately assess their ability to incorporate change. At the same time, fishers may report a low well-being yet have high resilience. For example, these fishers may resent the conditions under which they work, yet may be successful at incorporating change through being flexible and having a high income-earning potential.

Whilst some fishers might be resilient along some dimensions, they are not necessarily resilient on all four dimensions. Fishers can be weighted differently according to their response for all four components of their response to change. Some fishers are more flexible than others, whilst others are more confident than others, better able to plan and learn, or are further from their thresholds of coping. These results suggest that when discussing the ability of a fisher to be resilient, care is needed to specify each dimension of resilience. Then, whether boundaries that exist between valleys or basins within a sociological system have been crossed can be identified. It is conceived that a negative assessment of any one of these components can accelerate the rate at which a boundary between a 'desirable' and 'undesirable' domain of attraction is reached and exceeded.

In summary, this study has shown that social resilience is a complex and multidimensional concept, yet one that can be characterised by four key characteristics. Three of these are defining attributes of socio-ecological systems, while the fourth is unique to social systems. The revised conceptual model of social resilience, incorporating these four components, offers the potential for social resilience to be measured and predicted within resource-dependent communities such as the commercial fishing industry.

Chapter 8. Results II.

8

The Influence of Resource Dependency on Social Resilience

"The man least dependent upon the morrow goes to meet the morrow most cheerfully"

Epicurus (Greek philosopher, BC 341-270) in: The Essential Epicurus: Letters, Principal Doctrines, Vatican Sayings, and Fragments, by Eugene Michael O'Connor (Prometheus, 1993)

8.1 Introduction

Under what conditions is social resilience likely to change? This question is becoming more important to researchers and resource managers. Evidence is accumulating to suggest that human-use of resources is eroding socio-ecological resilience and that the institutions designed to protect system resilience have not been effective (Holling and Sanderson 1996, Adger 2000, Trosper 2003b). For institutions to be more effective, knowledge of the factors that erode and enhance social resilience is vital (Crean 1999, Adger 2000).

Adger (2000) first articulated that resource dependency is an important constraint on social resilience. Little effort has since been made, however, to understand how the level of dependency on a resource can specifically restrict the capacity of people to cope and adapt to change, and what the key drivers might be. However, people with greater dependency on the resource are expected to be less resilient to institutional change because they are regarded as being less flexible and more vulnerable to change (Haughton 2004).

Definitions of resource dependency and how and why resource-users might be dependent on a resource are mostly vague. Perhaps this is why the effect of resource-dependency on social resilience is only alluded to, rather than quantified. In order to address this need, a conceptual model of resource dependency was developed in chapter 3. Various social, economic and environmental factors were used to assist in the description of resource dependency within a

commercial fishing context. The model proposed that fishers that are socially dependent on a resource will include those fishers that have a strong attachment to the fishing industry and to their local community, have a low level of employability and have a family that have a low confidence in approaching change. Fishers that are economically dependent on the resource will include fishers of a low financial status, with small-scale operation and with a 'profit' approach to their business (as opposed to having a 'lifestyle' approach). Fishers who are highly specialised and knowledgeable of the local marine environment and spend all of their working hours fishing are described as environmentally dependent. However, whether all of these components of resource dependency are significant influences on social resilience is unclear. Identifying which components of resource dependency act to constrain social resilience may significantly progress our understanding of the causal mechanisms linking resource dependency and social resilience.

The aim of this chapter is to measure and test the influence of each component of resource dependency on the four components of social resilience identified in chapter 7. The results were expected to refine the conceptual model of social resilience (developed in chapter 5).

8.2 Methods

Quantitative data were collected in order to measure resource dependency and to test which components of resource dependency were important influences on social resilience. Survey questions, or statements, were designed on the basis of the conceptual model developed in chapter 3. Measures of social dependency included statements that assessed the attachment to the fishing occupation, attachment to the community, the level of employability and family circumstances (attitude to change and presence). Measures of economic dependency included statements that assessed the size of the business (turnover and number of employees), the business approach (lifestyle versus business) and the financial situation (income and debt level). Measures of environmental dependency included statements that assessed the level of specialisation, extent of local knowledge and the time spent harvesting. Responses were required in the form of a 4-point Likert scale; ranging from 'strongly disagree' to 'strongly agree'.

An initial version of the survey was pilot-tested with 15 fishing families in Townsville, as described in the previous chapter. The final survey statements (presented in the appendix) were administered to 100 commercial fishers in five communities in North Queensland as part

of a broader survey (as described in chapter 6) that also attempted to measure social resilience and examine the influence of other factors (such as policy perception) on social resilience.

A reliability analysis was used to assess the consistency between responses for each scale of social, economic and environmental resource dependency. Only those statements that contributed to the internal consistency of each scale were included in further analyses. A Cronbach's alpha of 0.7 or greater was accepted as indicating a reliable scale, where possible (Nunnally 1978).

Once the scales for resource dependency were established, the mean level of social, economic and environmental resource dependency (e.g. 'level of attachment to the occupation', 'employability' etc.) was calculated for each respondent. These values were then subjected to a Principal Components Analysis (PCA) in order to operationalise resource dependency for the commercial fishing industry (Kim and Mueller 1978). A PCA was chosen since it is a procedure that transforms a series of correlated variables into a smaller number of uncorrelated variables. The first principal component accounts for as much of the variability in the data as possible. Subsequent principal components gradually account for the remaining variability (Zeller and Carmines 1980). The analysis was expected to identify the main components of social, economic and environmental resource dependency. For example, social components such as the level of attachment to the occupation, level of employability etc. were expected to be correlated to some extent. A PCA on the mean values of each component was expected to recreate a subset of social components with minimal correlation between them. On the basis of the PCA, each respondent was assigned a factor score to represent their level of dependency for each scale. A factor score is a composite measure (like 'mean') that reflects the relative weighting of each statement in producing the scale.

In order to assess the significance of social, economic, and environmental resource dependency on each of the four dimensions of social resilience (as identified in chapter 7), a Pearson correlation analysis was conducted between (i) the factor scores of the PCA for the components of resource dependency and (ii) the factor scores of the PCA for social resilience that were produced in chapter 7. A Pearson's correlation coefficient is a measure of the strength and direction of the linear association between the independent and dependent factors. A Pearson's correlation allows an assessment of the likelihood that each independent variable is a predictor of the dependent variable. An alpha level of 0.05 was used as the

minimum level to assess the significance of each relationship (Underwood 1997). The relationship was examined graphically in order to maximise the accuracy of interpretation.

Qualitative data were collected as described in chapter 6. Qualitative data were collected in order to identify the possible causal mechanisms (i.e. how components of resource dependency act to influence the dependent variables) and to assist in the interpretation of the quantitative results (Beckley 1995, Smith 1995, Beckley 1998). Briefly, interview summaries for each of the 100 participants were constructed directly from the semi-structured qualitative interviews. A Content Analysis was used to analyse the data (Weber 1985, Stemler 2001). 'A priori' keywords such as the 'level of attachment to the occupation', 'attachment to the community', 'local knowledge' and 'employability' were used, although several other keywords were also used after an initial examination of the data. Key words were used to analyse the presence, meanings and relationships of words and concepts within texts and make inferences about the messages within them (Weber 1985). Conceptual links were then made between the variables and patterns identified (Henderson 1994). Simple flow diagrams were constructed to summarise the findings of the analysis.

8.3 Results

8.3.1 Developing the scale for resource dependency

Table 8.1 presents the descriptive statistics and results of the reliability analysis for each of the survey statements used to measure social dependency. Cronbach's alpha for the scale for the level of industry attachment was 0.700. Cronbach's alphas for the scale for attachment to place was 0.852 if one item was deleted ("I look towards my friends in the industry for support during difficult times") and Cronbach's alphas for the scale for employability was 0.723. The mean and standard deviation for each statement within each scale was based on a 4-point scale ranging from 1=strongly disagree, 2=disagree, 3=agree to 4=strongly agree unless otherwise specified.

Table 8.2 presents the descriptive statistics and results of the reliability analysis for each of the survey statements used to measure economic dependency. Cronbach's alpha for the scale for the size of the business was 0.619 suggesting that the scale to quantify business size could be improved. Cronbach's alpha for the business approach was 0.710. Cronbach's

alpha for the scale for the financial situation was 0.633 also suggesting that the scale could be improved.

Table 8.3 presents the descriptive statistics and results of the reliability analysis for each of the survey statements used to measure environmental dependency. Cronbach's alpha for the scale for the level of interest in the environment, local knowledge and harvesting skills was 0.709. The scales developed to measure the level of specialisation and the time spent harvesting were based on one statement each.

Table 8.1. Descriptive statistics and reliability analysis for the scale for 'social dependency'.

Survey items	**Mean**	**SD**	**Item-total corrlt'n**	**α if item deleted**
Level of industry attachment (a=0.700)				
I am a fisherman – I can't think of any other job I would rather do	3.586	.659	.570	.622
I would find it very difficult working for somebody else	3.280	.923	.226	.739
Being independent is the best thing about being a fisher	3.587	.659	.468	.651
I prefer being out to sea than on land	2.800	.944	.466	.651
I like being a fisher	3.720	.534	.606	.629
The fishing industry to me is a lifestyle – it is not just my job	3.520	.794	.417	.664
Attachment to place (a=0.852 if item deleted)				
I feel like I belong to this community/town	3.425	.759	.520	.284
I am proud to tell people in my town/community that I am a fisher	3.362	.860	.198	.367
I plan to be a resident of this town/community for a number of years	3.500	.746	.615	.260
I have some very strong friendships in this town/community	3.375	.752	.465	.300
The friendships I have with people in this town/community mean a lot to me	3.412	.723	.434	.313
If I needed advice about something I could go to someone in my community	3.025	.899	.272	.342
Employability (a=0.723)				
What is your highest level of education?**	3.698	1.495	.295	.753
Have you ever done any courses to improve your business?***	1.397	.492	.186	.736
Could you easily get a job [outside of the industry] in this area again?***	1.253	.437	.586	.705
It is a waste of my skills to get a job outside of the fishing industry*	1.891	1.036	.350	.718
I have many options available to me if I decide to no longer be a fisherman	1.590	.897	.644	.668
I am too young to retire, and too old to find work elsewhere*	1.650	.889	.349	.717

Survey items	Mean	SD	Item-total corrlt'n	α if item deleted
Our skills would be useful in setting up a business other than in fishing	2.313	1.046	.321	.724
We would be nervous trying something else*	1.819	.925	.634	.668
I am confident that I could quickly gain work outside of the fishing industry if I needed to	1.879	17.654	.600	.671
Family attitude to change (a=0.701) Answered by the spouse				
I cannot imagine my spouse working for someone else	3.611	.684	.107	.709
We are more likely to cope with changes compared to other families we know	2.666	.990	-.091	.749
I would love my spouse get a profession other than fishing	1.833	1.023	-.290	.780
I believe that the future will look after itself	1.574	.815	-.049	.732
I feel like I belong to this town/community	3.481	.884	.445	.665
I often socialize with people in my town/community	3.518	.574	.583	.660
I have many family/friends within an hours drive of this town	3.370	.937	.653	.628
I have some very strong friendships in this town/community	3.444	.793	.760	.620
The friendships I have in this town mean a lot to me	3.500	.720	.730	.631
It is important to know how other fishing families are coping	3.203	.786	.538	.654
I look towards other fishers for support during difficult times	2.703	1.002	.548	.645
If I needed advice I could go to someone in my community	3.166	.905	.614	.636

Notes: (*) The data for negative worded statements were reversed prior to analysis
(**)Measured on a 6 point scale ranging from year 7 to year 12
(***) Measured on a 2-point scale (1=no and 2=yes)
(****) Statement removed from the scale

Table 8.2. Descriptive statistics and reliability analysis for the scale for 'economic dependency'.

Survey items	Mean	SD	Item-total correlation	α if item deleted
Size of business (a=0.619)				
How many people (outside of family) did you employ over the last 12 months?	3.971	8.649	.463	.525
Approximately, how much income does your business turnover each year?**	3.471	2.048	.584	.383
How many fishing boats do you have?	1.671	.958	.227	.535
How big is each fishing boat (m)?	11.305	4.104	.465	.302
Business Approach (a=0.710)				
Every time there is a new change in the industry, I plan a way to make it work	2.878	.950	.316	.666
I feel uncomfortable making decisions without information about changes	3.554	.761	.034	.691
I always know how much money is coming in and out of my business	2.945	1.032	.194	.679
I always share my business concerns with my spouse	3.621	.589	.254	.675

Survey items	Mean	SD	Item-total correlation	α if item deleted
I tend to ignore proposed changes and wait to deal with them later *	2.986	1.040	.027	.698
I am always thinking of new and better ways to improve my fishing business	3.770	2.485	.283	.708
We always get professional advice before making a business decision	2.662	1.125	.418	.651
We can never guess how much money our business will make each month	3.297	.902	.428	.655
We have a detailed business plan for the following year	2.202	1.110	.521	.638
We have a 5-year business plan	1.891	1.054	.487	.644
Our business is growing slowly into something bigger	2.337	.969	.250	.673
Our skills would be useful in setting up a business other than in fishing	2.270	1.050	.275	.670
We often talk about the state of our business with a business professional	2.743	1.034	.504	.642
We would be nervous trying something else*	1.729	.848	.237	.674
I am always interested in learning new ways to improve my business skills	3.013	.957	.449	.651
Financial situation (a=.633)				
How much business debt do you have left to pay off?***	2.076	1.228	.159	.259
What proportion of your households income comes from fishing?****	4.307	1.044	.269	.200
How much income from the fishing industry do you take home each year?*****	2.446	1.723	-.015	.425
Do you own, rent or are paying off your home?******	1.646	.738	.140	.282
We always have an amount to cash available for emergencies	2.707	1.085	-.142	.423
Our house will probably have to be sold if our fishing business fails*	2.415	1.210	.405	.082
Fluctuations in the market-price of our fish product significantly affect our monthly income*	3.169	.977	.257	.213

Notes: (*) The data for negative worded statements were reversed prior to analysis

(**) Measured on a 7-point scale ranging from $0-50K to >$350K

(***) Measured on a 4 point scale ranging from $0-10, $11-40K, $41-100K, >$101K

(****) Measured on a 5-point scale ranging from <20% to >80%

(*****) Measured on a 6-point scale ranging from $0-30K, $31-40K, $41-50K, $51-60K, $61-70K, >$71K

(******) Measured on a 3-point scale ranging from 1=own home, 2=mortgage, 3=rent

Table 8.3. Descriptive statistics and reliability analysis for the scale for 'environmental dependency'.

Survey items	Mean	SD	Item-total correlation	α if item deleted
Level of specialisation				
What are the main species that you fish for? (# species)	3.8	2.65	.	.
Time spent harvesting				
How many day/nights were you fishing over the previous year?	152.7	69.93	.	.
Interest in the environment, local knowledge & skills (a=.709)				
I prefer being out at sea than on land	2.795	.933	.302	.624
Big companies will be the only ones to survive future changes in the industry	3.337	.859	.191	.640
I like to think of myself as 'environmentally sensitive'	3.626	.675	.166	.642
There are too many fishers in the fishing industry here in QLD	2.975	.923	.348	.617
I am concerned about the level of illegal (commercial) fishing that is occurring	2.879	1.097	.388	.608
I would like to learn about 'sustainability of the fisheries resource'	3.228	.770	.252	.632
The technology within the industry means that anyone can be a skilful fisher	2.108	.962	.045	.663
I would like to spend more time fishing	2.710	.969	.346	.617
I have some good ideas about how to ensure the sustainability of my species	3.433	.647	.482	.608
For safety reasons, I prefer to work with other boats around, whilst out at sea	2.096	.932	.075	.658
I would be good at teaching younger people about the marine environment	2.927	.997	.301	.624
There are too many other fishers working in the areas that I fish	3.313	.679	.078	.651
I am confident that my skills will mean that I am successful in the industry	3.120	.787	.342	.620
A good fisherman knows a lot about the biology of their main species	3.277	.703	.302	.627
I am always learning about the ecology of the marine environment	3.325	.827	.366	.616
My life seems to be ruled by the weather	3.373	.851	.172	.643
I am proud to tell people in my town that I am a fisher	2.795	.933	.302	.624

Each respondent was given a mean value for each of the scales for resource dependency based on the results of the reliability analysis above. Mean values were subjected to a Principal Components Analysis (PCA) and the results are presented in tables 8.4, 8.5 and 8.6. Table 8.4 suggests that social factors were best described by two components, explaining 77% of the variation. Table 8.4 shows that the first social factor is a combination of the attachment to

place and family circumstances ("local influences"). The second social component is a combination of the level of employability and attachment to the occupation ("personal influences").

Results in table 8.5 suggest that economic factors of resource dependency were best described by two components, explaining 79% of the variation. Table 8.5 shows that the first economic component is a combination of the business size and approach ("business influences") and that the second economic component reflects the financial situation.

Results in table 8.6 suggest that environmental factors were best described by one component, explaining 58% of the variation ("environmental influences"). The factor scores for each component were saved and were used to represent the 'mean' value for each respondent. A factor score is a composite measure extracted from the PCA that reflects the relative weighting of each statement.

Table 8.4. Principal Components Analysis on the social component of resource dependency

	"Local influences" PC 1 55.56%	**"Personal influences" PC 2 21.27%**
Attachment to place (mean of scale)	.934	.
Family attitude (mean of scale)	.811	.
Employability (mean of scale)	.	-.933
Attachment to occupation (mean of scale)	.	.786

Notes: (.) Factor loading scores less than 0.50 are not displayed
PC=principal component

Table 8.5. Principal Components Analysis on the economic component of resource dependency

	"Business influences" PC 1 45.82%	**"Financial situation" PC 2 33.65%**
Business size	.830	.
Business approach	.828	.
Financial situation	.	.993

Notes: (.) Factor loading scores less than 0.50 are not displayed
PC=principal component

Table 8.6. Principal Components Analysis on the environmental component of dependency

	"Environmental influences" PC 158.21%
No. of species targeted	.695
No. of days/nights spent fishing	.676
Environmental interest/skills	.559

Note: PC=principal component

8.3.2 The influence of resource dependency on social resilience

Table 8.7 shows the results for the correlation between (i) each of the factor scores identified in the above PCA for each component of resource dependency and (ii) each of the factor scores for each component of social resilience identified in chapter 7. Results show that the factor scores for "personal influences" and "business influences" were significantly correlated with components of social resilience (table 8.7). Personal influences were negatively correlated with the first and third dimension of social resilience; 'risk assessment', and 'proximity to the threshold of coping'. Business influences were positively correlated with the second and third dimensions of social resilience; 'the ability to plan and reorganise' and 'proximity to the threshold of coping'. "Local influences", "the financial situation" and "environmental influences" did not appear to have a significant relationship with any dimension of social resilience.

Table 8.7. Results of the Pearson Correlation matrix examining the relationship between (i) each of the factors scores for the components of social resilience (Y1 to Y4) identified in chapter 7 and (ii) each of the factor scores for the components of resource dependency.

Resilience Components:	**Y1: Risk**	**Y2: Planning**	**Y3: Coping**	**Y4: Interest**
Social factors				
Local factors (place, family)	-.116	.133	-.016	.071
Personal factors (employability, attachment to occupation)	-.678**	-.106	-.340*	-.073
Economic factors				
Business factors (size, approach)	.250	.436**	.309*	.083
Financial situation	.194	.130	.121	.104
Environmental factors				
Specialisation, time, interest	.032	.057	.034	.055

Notes: ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

8.3.3 Interpretation of the influence of resource dependency on social resilience

8.3.3.1 Graphical interpretation

Since the components of resource dependency were regarded as rather complex to interpret, they were isolated into their more basic units and analysed graphically. The factor scores for the independent factors were recoded into categorical data so that any relationship could be visualised more clearly. Factor scores were divided into five equal categories ranging from low to high, small to large, or 'lifestyle approach' to 'profit approach'. The significance of the relationship was assessed using a Pearson correlation analysis.

Figure 8.1 suggests that commercial fishers with a low level of employability (as measured by age, education and attitude to working elsewhere) tended to negatively assess the level of risk associated with change and negatively assess their ability to cope compared to fishers with a higher level of employability. Fishers with a low employability were older, had fewer transferable skills, less formal education and had a negative attitude to working elsewhere.

Figure 8.2 suggests that fishers with a low level of attachment to the fishing occupation were more likely to positively assess the risk associated with a proposed policy change and were more likely to positively assess their ability to cope with policy change compared to fishers with a high level of attachment to the fishing occupation.

Figure 8.3 suggests that fishers in smaller businesses (as assessed by the number of employees and financial turnover) were more likely to negatively assess the level of risk associated with a proposed policy change and negatively assess their ability to cope compared to fishers in larger fishing businesses.

Figure 8.4 suggests that 'lifestyle fishers' (in which the fishing business is not 'growing' and fishers are more interested in the lifestyle benefits than they are in the economic returns) were less likely to assess their ability to plan and cope as positively as fishers that are more 'profit-oriented'. Figure 8.4 also suggests that fishers that are at the extreme end of the "profit-oriented" scale negatively assessed their ability to cope.

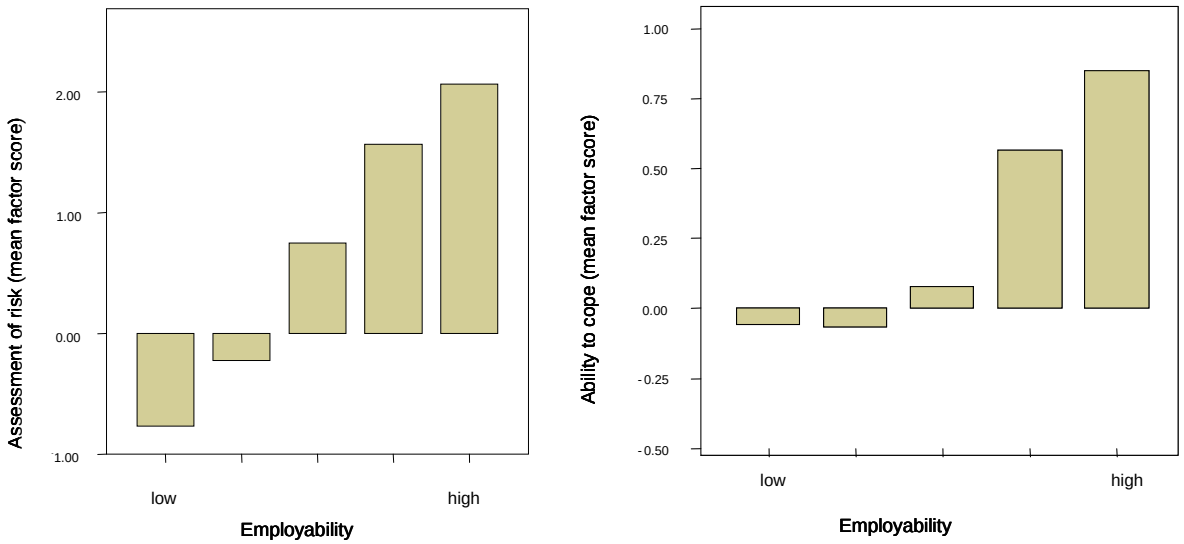


Figure 8.1. Direction of influence of employability on (i) the assessment of risk (Pearson correlation= .721 which is significant at the .01 level), and (ii) the ability to cope (Pearson correlation=.149).

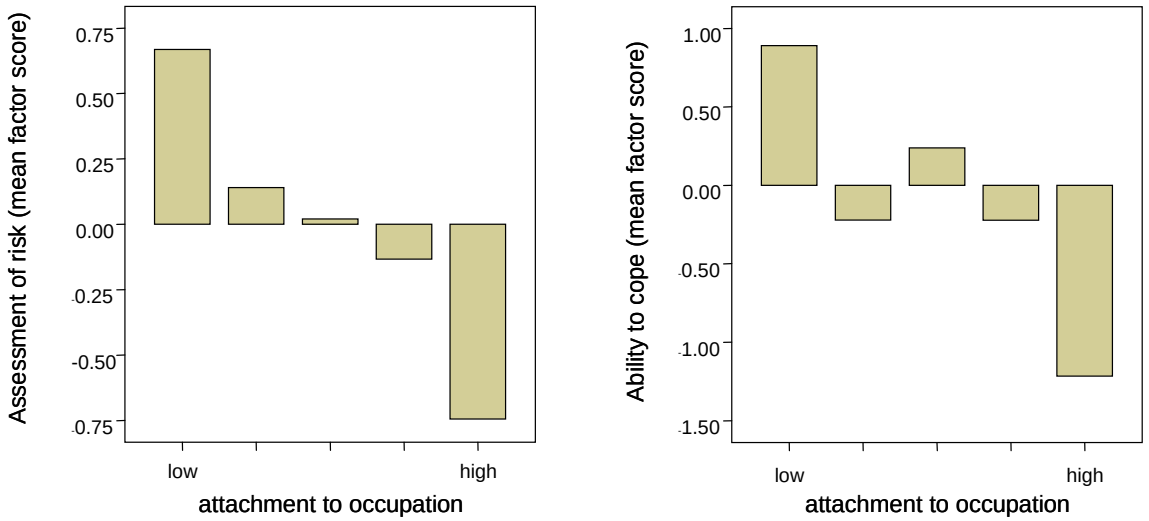


Figure 8.2. Direction of influence of attachment to the occupation with (i) the assessment of risk (Pearson correlation= -.286 which is significant at the 0.05 level) and (ii) the ability to cope (Pearson correlation=-.082).

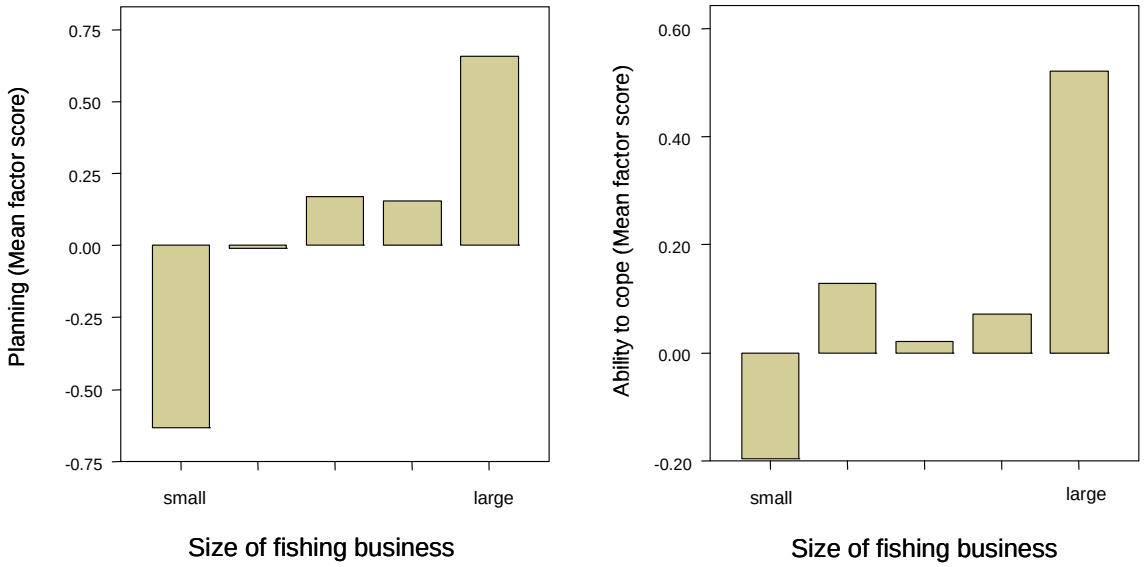


Figure 8.3. Direction of influence of business size (number of employees and turnover) with (i) the ability to plan (Pearson correlation= .342 which is significant at the .01 level) and (ii) the ability to cope (Pearson correlation= .195).

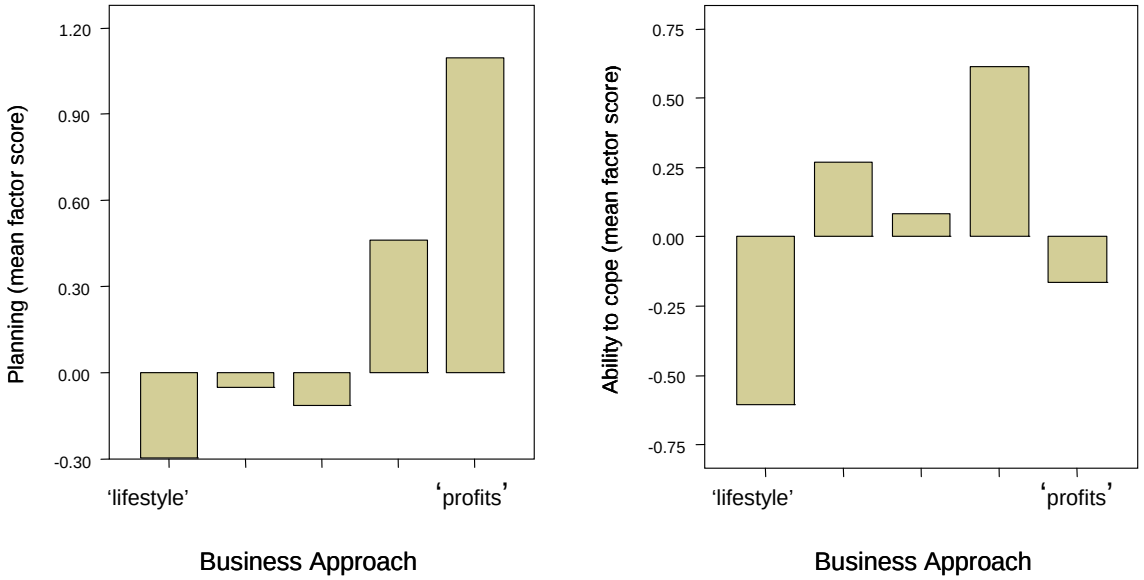


Figure 4. Direction of influence of business approach (rate at which business is 'growing') with (i) the ability to plan (Pearson correlation=-.295 which is significant at the .05 level) and (ii) the ability to cope (Pearson correlation= 181).

8.3.3.2 Qualitative Results

In this section, components of resource dependency are qualitatively assessed in order to identify how they act to influence social resilience and to assist in the interpretation of quantitative data (Beckley 1995, Smith 1995). A brief description of each factor is also presented.

8.3.3.2.1 Level of attachment to the fishing occupation

The literature describes the level of attachment to the occupation in terms of the nature of the work and in terms of an occupational community. Hence, qualitative results are presented here to describe both.

a. Describing the nature of the attachment

Most fishers in this study were deeply attached to the notion of being a fisher. Fishers generally described their occupation in passionate terms, for example, "the lure is so strong that I cannot stay away", and "I just love fishing!" Fishing offered a lifestyle that was extra-ordinary and completely consuming for many, as illustrated by comments such as, "there is thrill and adventure and excitement that ordinary life does not provide", "I love the hunt, the competition", "I wouldn't swap my life for any other" and, "even if someone offered me a fantastically paid job, I would never take it." Some fishers made comments such as, "you could not take me away from the ocean", suggesting that it was the ocean itself that was the main attraction. In general, however, the ocean appeared to provide an environment in which fishers could be their own master. Many made reference to the independence that fishing allowed them, where the notion of a 'nine-to-five' job was extremely unattractive, and if forced to take on such a position, their "soul would be destroyed".

Many fishers also felt that fishing was an occupation at which they were particularly accomplished. Several fishers indicated that they had not been very talented at school, and fishing provided an opportunity to excel at something which was important to them. Fishing allowed many to demonstrate their competence in a challenging and unique workplace. This frequently related to the physical demands of the profession. The way in which these aspects were discussed seemed to reinforce their level of attachment to the industry rather than detract from it; for example, "you have to be an engineer, a doctor, a plumber, a cook and a

priest!" In a similar way, the negative aspects of being a fisher were discussed as a 'matter of fact' rather than as a complaint. Mostly, they related the physical and other unpleasant demands of the profession as an opportunity to show how physically able they were. It was as if many found solace in working hard. For example, after one fisher separated from this wife he, "worked on the boat like a madman." Many fishers took pride in their physical strength relative to non-fishers. Some described working on board in rough weather, working at night and how they could go for extraordinary periods without decent sleep. Others described the skill involved in finding and catching fish and/or prawns and dealing with the constant daily challenges that plagued sea-going machinery.

The reasons as to why fishers were so attached to their occupation were explained using comments such as, "I have been fishing since I was 15" or, "I come from a really big fishing family". Wives were sometimes better at describing what fishing meant to their husbands in these instances. For example, one wife described her husband as, "a different person out at sea. On land he is introverted, unsure of himself and clumsy. At sea he is in total control: confident and extremely capable". One wife explained that her "husband would die without fishing", and another explained how her husband's self-identity was strongly connected with being a fisher, such that, "my husband's job is fishing – but it is more than that – he IS a fisherman".

Not all fishers were attached to the industry. Just as fishers had to contend with the difficulties of their unique physical environment, they were also required to deal with the problems of their complex social environment on land. Husbands and fathers needed to be away from their families in order to fish – and sometimes for a substantial amount of time. Many fishers were divorced and blamed their occupation. One fisher described how his family had left him, and that he could understand their reasons, since he was not even able to emotionally support his young son who was keenly involved with school sports.

b. Level of interaction with other fishers

Fishers talk a lot with other fishers during uncertain times (when a policy change is proposed and at which time rumours are said to be rampant). Those fishers that are perceived as knowing more than other fishers about pending changes are commonly sought out for advice and information. At other times, however, the level of interaction amongst fishers is minimal unless fishers are family members or established friends. Many fishers described how they

preferred not to interact with other fishers and actively avoided working and socialising with each other where possible. For example, "I go fishing by myself because I like it that way", "the live prawn industry is cut-throat, competitive, bitchy and nasty", "the solitary lifestyle is important to me". One skipper, for example, described how he purchases video games to keep the crew from talking to him during meal times. Frequently, fishers do not even identify with each other. For example, fishers made comments such as, "fishermen just aren't my sort" or, "so many fishers have personal problems – drugs, relationship problems, no financial management skills, or have antisocial behaviour". Others felt that fishing is such an extreme lifestyle, that they crave 'normality' when on land and prefer the company of non-fishers; for example one wife explained, "we don't socialize with other fishers as a policy - we want a normal life".

The lack of interaction with other fishers had minimal influence on the level of attraction to the fishing industry. Fishers were predominantly antisocial and the level of attachment to the industry was clearly developed independently of other fishers. Some of the older fishers explained that, "things aren't like they used to be", referring to higher levels of camaraderie within the industry when they were younger. One older fisher openly wept at the recent loss of his best friend with whom he had been fishing for the last 40 years. More recently, however, fishers tend to be much more suspicious of each other. Some fishers implied that trust between fishers was being actively eroded (by fishery agencies) as a management strategy to hasten the demise of the industry.

Where strong links did exist between fishers, these tended to be family bonds, or established friendships, for example, "my brother-in-law also fishes, and we spend a lot of free time together", and "our family is all involved in fishing, so that is all we talk about!". In these instances, interaction with other fishers probably did reinforce self-identity. Many fishers had come to the industry of their own accord, however, many fishers were introduced to the industry through fathers, grandfathers, uncles or brothers.

Overall, it was evident that fishers took enormous pride in being independent. They were free from regimentation and could work outdoors. They were their, "own boss". One older fisher described how many of his male acquaintances (in other professions) had died soon after the death of their wives. In order to emphasise how independent he (and other fishers) was/were, he told me that although he loved his wife dearly, he could not relate to this – he knew he could survive without her.

c. Interpretation of quantitative results and the influence of attachment to the occupation on social resilience.

Quantitative results suggested that, in combination with the level of employability of fishers, the level of attachment to the fishing occupation was a highly significant influence on the assessment of risk – the main dimension of social resilience – and the perception of the proximity to the threshold of coping (chapter 7). Qualitative results support this finding. Qualitative results suggest that where there was excessive attachment to the industry, fishers were unwilling to consider alternative forms of employment. They found it extremely difficult to imagine a life outside of the industry. When asked what they might do if they could no longer fish, fishers who were excessively attached would make comments such as, "I dunno. I'd probably keep fishing", "I couldn't really do anything else" or, "I guess I could be a fisheries patrol officer, or something." Fishers in this situation showed little interest in further developing their ideas. The more firmly attached an individual was to their occupational identity, the more traumatic and disorienting the potential loss of their livelihood would be. Hence, as reflected in the quantitative results, the more firmly attached an individual was to their occupational identity, the less positive they were in their perception of the risk associated with change (dimension 1) and their proximity to the threshold of coping (dimension 3).

Figure 8.5 provides a summary that illustrates the mechanism describing how the level of attachment to the fishing occupation can significantly affect resilience to change. It also shows that the negative response to policy change for fishers who are highly attached to their occupation is probably also due to their generally low level of employability. Fishers who were highly attached to the fishing occupation tended to have fewer transferable skills, were older and had fewer employment options to access if necessary. These fishers were aware that few other opportunities existed for them outside of the industry and that they would be unlikely to find suitable alternative employment. They made comments such as, "I am 60 and have fished all of my life. What else am I going to do?"). Fishers provided evidence by explaining that they had, or had known another fisher who had left the industry on a previous occasion to seek their fortune elsewhere, only to return to the fishing industry because they were unsuccessful in obtaining alternative employment. Fishers with a high level of attachment to their occupation and often their wives explained that if they were not able to continue within their chosen occupation, then, "life would hold no meaning"; they would become severely depressed and "go on the dole", becoming welfare dependent. Fishers in these circumstances are thus unlikely to secure alternative employment and their level of dependency on the

resource is thus exacerbated. These fishers are likely to become excessively depressed since their identity is so intimately interconnected with their occupation.

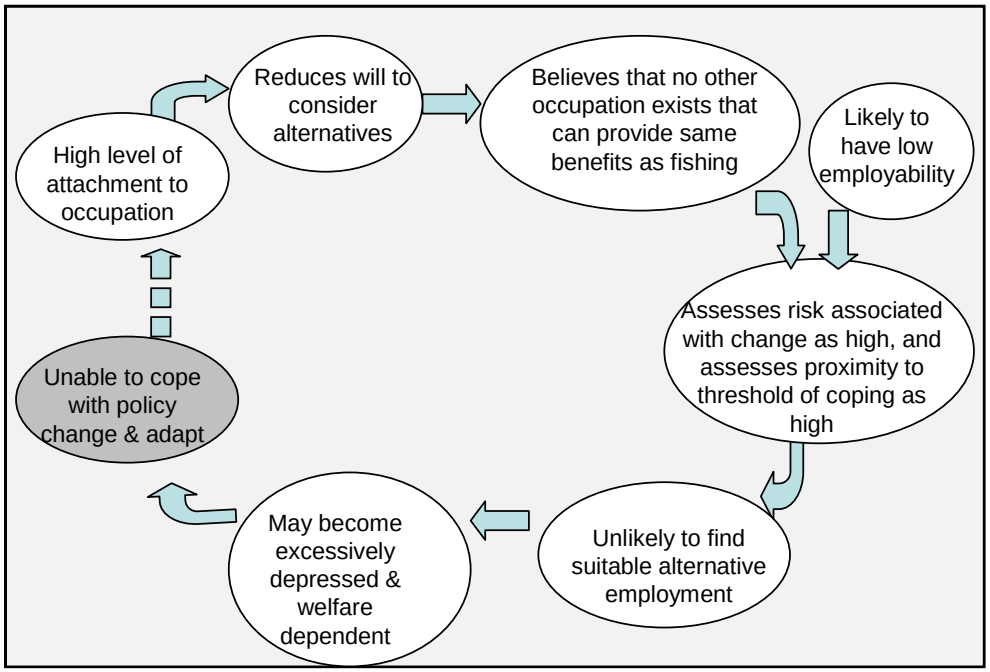


Figure 8.5. A summary of qualitative results: a mechanism to describe how the level of attachment to the fishing occupation can significantly affect social resilience.

8.3.3.2.2 Employability

a. Describing the employability of fishers

A great many commercial fishers in thus study were older, had few transferable skills and were worried about securing work elsewhere. These fishers are described as being 'unemployable'. Fishers were obviously acutely aware of their relative competitiveness within the labour market, and vehemently described why their continued existence within the commercial fishing industry was important. Many fishers in this study were close to retiring but were not quite financially, mentally, or physically prepared. The average fisher in this study was 52 years old. Older fishers took pride in being physically fit and active, and believed that they could expect a long working life. Older fishers, however, were particularly worried about their future prospects believing that they were mostly unemployable in the event of an institutional change that put them out of business. One fisher said, for example, "I am 60 and have fished all of my life. What else am I going to do?" Another said, "at 56 years of age, there is no way I could get work elsewhere". Older fishers are often ineligible to receive welfare benefits such as the

'dole' scheme because of their relatively high number of assets. They are also too young to receive superannuation or the 'old-age pension'. Hence, the most realistic option for some of these fishers was to significantly reduce their standard of living (and sell some of their assets) until they are old enough to access other financial sources. Many fishers believed that their fishing assets have also recently significantly dropped in value since recent changes in legislation has meant that there is no market for fishing equipment.

Many had a low level of formal education and this was a major deterrent in searching for jobs outside of the industry. One spouse explained, "he has never learned to read. He wouldn't survive anywhere else". One said, "no one in their right mind would ever employ my husband- he was meant to be a fisher, and would be useless at anything else." Another said, "He is just too old to be retrained", and another said, "my husband wouldn't be able to do any work other than fishing, unless it was labouring – but then he is too old to do that, too." Thus, fishers saw themselves as having very few other options in society other than occupations such as 'fisheries patrol officer', or, for the younger fishers, labouring. Younger fishers were generally more confident of their ability to fall back upon a trade, if they had one, or to secure alternative employment, compared to older fishers.

b. Interpretation of quantitative results and the influence of employability on social resilience

Quantitative results suggested that, in combination with the level of attachment to the industry, the employability of fishers was a highly significant influence on social resilience. Qualitative results support this finding. Qualitative results suggested that low employability increased the dependency that fishers had in maintaining their current occupation as a fisher. Fishers believed that more employment and business opportunities existed for younger, skilled people. Fishers in this study that had a higher level of employability were more positive about their options for the future. Fishers who were the most negative towards their ability to secure work elsewhere tended to be small-scale/lifestyle fishers in their fifties. These fishers described how they did not have the "energy" to secure alternative employment or "start again". These fishers were preparing to retire and were uninterested in beginning a new occupation. Hence, fishers with a low level of employability were less likely to be positive in their assessment of their response to policy change. Low employability was thus highly correlated with low social resilience.

Figure 8.6 provides a summary that illustrates the mechanism describing how personal attributes, attitudes and abilities (employability), within a community or society with limited opportunities, can significantly affect resilience to policy change. It shows that fishers with low employability in conjunction with fishers with a high attachment to the occupation and a limited number of outside opportunities assess the risk associated with change as high and assess the proximity to their threshold of coping as close. These fishers believed that they were unlikely to find suitable alternative employment. Small-scale/lifestyle fishers in their fifties were especially vulnerable to institutional change since their interest in starting a new career ("starting again") was also very low. These fishers believed that a policy change requiring them to leave the industry would mean that they were unemployed, without income and without 'dignity'. Since many fishers were ineligible to receive welfare benefits, and since they were too young to access their superannuation or the old-age pension, they believed that a change in fisheries policy that rendered them unviable within the industry would have significant impact. These fishers struggled to provide a vision for what they might do, other than, "survive somehow until we can get the old-age pension."

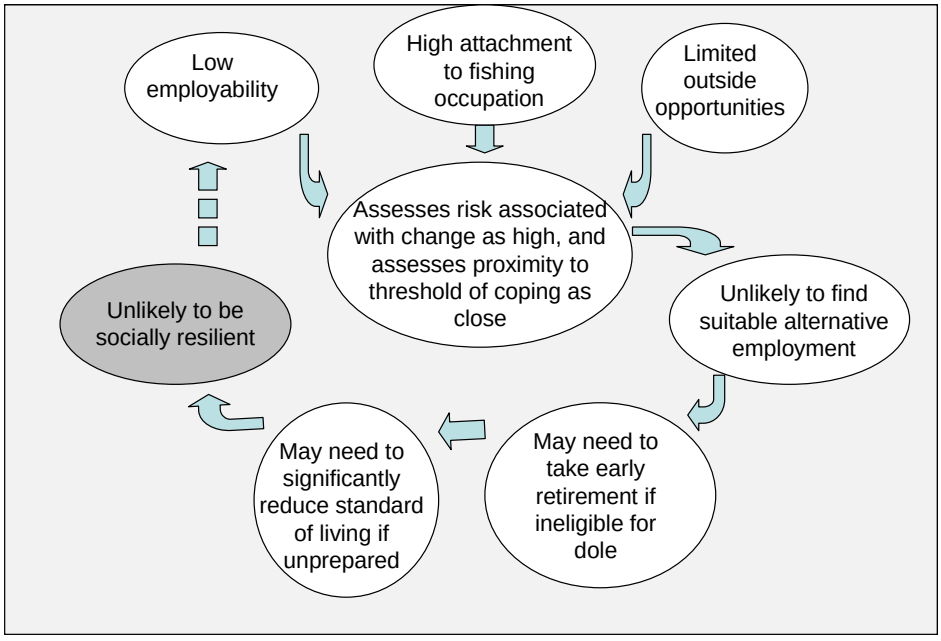


Figure 8.6. A summary of qualitative results: mechanism to describe how personal attributes, attitudes and abilities, embedded within a community or society with limited opportunities, can significantly affect resilience to change.

8.3.3.2.3 Family circumstances and attitudes

a. Describing family circumstances and attitudes.

Most fishers were married or in a relationship (85%) (table 6.5, chapter 6). The level of involvement of women and other family members in the fishing business was variable. Most wives (56%) were involved in the fishing business at least on a part-time basis and most (52%) had an additional income outside of the fishing industry (table 6.5 chapter 6). However, qualitative results showed that women mostly regarded themselves as 'helping out' their husbands such as by 'doing' the books and filling-in the logbooks. Some women were well aware of their contribution to the fishing business and discussed how important they were in keeping down costs. Some women clearly ran the fishing business; from employing crew and looking after their interests (such as wages, superannuation, setting up savings plans for them etc), to organising the boats when they were in port (cleaning, processing the seafood and restocking with supplies) and keeping up-to-date with changes in fisheries legislation. Many women were also the liaison person with fisheries managers in the discussion of new licence requirements.

When times were financially difficult, women obtained additional work to support the family. In this way, the consequences of institutional change could have far-reaching impacts within a family. One fisher described how (as the result of a previous change in fisheries legislation), "my wife has kept us going over the last 6 months by packing tomatoes". This meant that either (i) the business had to do without her help (for example, one spouse wrote on the back of their survey, "I have had to seek fulltime employment to supplement the household income. I am therefore unable to assist and reduce costs in the fishing business"), which meant that the fishers themselves had to learn the necessary skills, or the business suffered, or (ii) the wife was required to complete her normal tasks in addition to her paid job. Either way, some families were experiencing significant strain as a result. Wives made comments such as, "the tension in the house has been so bad" and, "I am working as hard as I can, and this [proposed policy change] is putting much stress between us".

Sometimes, the strain was not only as a result of financial stress and exhaustion, but also because family values had been compromised. Specifically, many fishers were uncomfortable with the idea that their wife was out in the workforce, and that they were no longer fully providing for the family. For example, fishers made comments such as, "my wife shouldn't

have to work to support us", "my wife has to work two jobs since my business isn't making enough profit". Fishers were not opposed to their wives working, per se, but rather that that their wives were forced to take on what they regarded to be relatively "demeaning work". Fishers that had wives in jobs such as cleaning, were particularly distressed, and didn't believe that this was "right". For example fishers made comments such as, "my wife has two casual jobs cleaning now" and, "my wife has to work as a commercial cleaner to support us".

Fishers faced with the prospect of policy change that meant having to search for fishing or work opportunities in another community were forced to consider their family's attachment to the community. Even if the fisher was prepared to leave the community in order to improve the family's financial situation, the rest of the family often was not. Families, in contrast to fishers, could be very attached to the community since, when fishers were at sea for long periods of time, they turned to other community members for support and interaction. Wives made comments such as, "I don't feel alone when my husband is away". One woman described her attachment to the community by describing her relationship with other fishing families nearby; "last year I miscarried 8 weeks before my due date. The other fishing families in the area wept with us". Another family described their attachment to the house they lived in. The wife explained, "we have lost our son who grew up in this house. We could never leave". The attachment to the community rarely extended beyond the closer network of friends and relatives. Many fishing families described feelings of isolation outside of their network of family and friends. Some fishing families were quite concerned and even distressed at their community's opinion of fishing.

b. Interpretation of quantitative results and the influence of family circumstances and attitudes on social resilience.

Family circumstances and attitudes were statistically insignificant in influencing social resilience. This may be because the sample size was not sufficiently large to differentiate between fishers with wives and without wives since the amount of variability within each group was considerably large, and only 15 fishers were without wives/partners (table 6.5 chapter 6). Qualitative results suggested however, that families could influence resilience of commercial fishers in complex ways. For example, on the one-hand, the presence of families acted to support fishers in their business and assist them in being more competitive within the industry; however the presence of families may also have acted to deter the fisher in experimenting with his options for the future and take larger risks. For example, one younger

fisher who had recently married and had a small baby explained how he used to be financially better off because he fished "in the green zones [no fishing zones]". Now, he explained, since he had a family, the risks were too large and he was not prepared to subject his family to the consequences of "being caught". Fishers were also aware that a change in fisheries policy would also impact on the family, and that this would put additional stress on the family-business unit. This stress could take the form of financial stress or the stress at leaving the community within which family and friends also existed. Either way, the additional stress of policy change within a fishing family can push fishers and their families closer to their thresholds of coping. These results suggest that the quantitative analysis was too simplistic to capture the complex nature of social resilience and its influences.

8.3.3.2.4 Community attachment

a. Describing the attachment to the community

Many fishers were relatively well-established within their communities, especially those that were older. One family that lived in Cooktown had lived in the same house for 7 generations (the fisher was the 5th generation, and his grandson was living with them). Another fisher described how he, "chose Cooktown to live because it is out-of-the-way", and would not consider moving elsewhere to search for work. Nonetheless, for most fishers, community attachment was not necessarily an attachment to the place itself, but rather an expression of the opportunity to spend time with family, and in particular, children and grandchildren. In these instances, community attachment acted to reduce the flexibility that fishers had to pursue employment (including fishing) opportunities elsewhere. Older fishers that had lived in their community for some time and also had grandchildren living there were often unwilling to leave their community. Some fishers explained that they had worked, "really hard all [their] life" and had missed out on watching their own children growing up. Grandchildren living nearby were important for these fishers. For example, one fisher explained that, "we have grandchildren in the area, and we would never leave them". In addition, several fishers were divorced. Divorced fishers believed that if they left their community, it would be nearly impossible to spend time with their children, especially if the relationship with the mother was "nasty". Several divorced fishers expressed their concern and worry about the possible need to leave the community in search of work elsewhere. In one instance, a fisher was the primary carer of a small child. He explained that he was particularly attached to living in his community because, "my wife has left me and my 4 year old son. I couldn't do it without the

help of my mum who lives nearby" (insinuating that he could not also expect his mother to leave her community and follow him elsewhere).

Fishers who did not have a family, however, appeared to be much more willing to move from their community to take advantage of employment opportunities elsewhere. For example, one single and younger fisher living in Bowen said, "the money is good in Bowen at the moment. I'll move on when I need to". Many fishers and their families were, in fact, not very attached to their community, aside from their families and friends. Families believed that the community did not value or understand what the fishing industry provided. For example, some fishing families believed that, "fishermen no longer have status in society". According to many fishers in this study, fishers were regarded as, "rapists and pillagers of the marine environment" and even criminals, for example, "I feel like scum when I tell people I am a fisherman", "society is giving me a loud message – I am not wanted" and, "I often get harassed at boat ramps". One woman described how she overheard a man in a hardware shop describing to his friend that he was in the process of putting a lock on his garage door because a fishing family moved in next door. To her horror, she realised that it was her own neighbour speaking. Some wives described how they were too embarrassed to say what their husbands did for a living, and one woman explained that, "even my own parents do not respect my husband's profession". In other families, children have come home from school wanting to know why their fathers were doing, "such bad things to the [marine] environment". Such comments were especially discouraging for fishers, yet most earnestly believed in what they were doing. They believed that unfavourable media coverage and ignorance were the main reasons why the community perceived them so badly. Fishers and their wives believed that, "if the community were better informed about fishing, then we would be helped considerably" and, "a lot of our problems stem from bad public relations". Many fishers were exasperated that people continued to purchase seafood, yet would harass the industry at any opportunity; "it is as if the public do not make a connection between the seafood that they eat and fishing". Since sales of seafood were on the increase, however, fishers took this to mean that their efforts really were valuable and important.

b. Interpretation of quantitative results and the influence of place attachment on social resilience

Quantitative results suggested that the level of attachment that a fisher had to his community was insignificant in influencing social resilience. Qualitative results suggest that this finding may have been observed because fishers did not really have a strong affinity with their

community. Fishers found that the communities within which they lived were mostly hostile towards commercial fishers. The community mostly represented a place in which their family resided, and for this reason divorced men and grandfathers were reluctant to leave the region in search for work elsewhere.

8.3.3.2.5 Economic factors

a. Describing business size, approach and financial factors.

Most of the fishing businesses in this study were small family-based businesses with very few employees, if any. Only a small number of fishing businesses in this study were large-scale multi-million dollar enterprises employing large numbers of crew. The largest operator had 60 employees, although most 'big businesses' employed around 8-20 people (see table 6.5, chapter 6). There were some businesses that operated as a father/son team and some with two or three sons or brothers involved.

The range of business strategies and approaches employed by fishers in this study was diverse. Some fishers were very relaxed in their financial expectations whereas others were driven to maximise their profits: some where more interested in the associated 'lifestyle' whereas other fishers had completed business courses and continually derived plans to "get rich". Fishers that were motivated by economic incentives spoke candidly about their plans. For example, fishers made comments such as, "I believe in budgeting"; "we put good friends on as skippers who we trust absolutely"; "I have set up the business to provide incentives to be skilful and not lazy"; "we just work very, very hard"; "I sell my old gear to other fishers who waste their time fixing it" and; "if we could be out on the water for one hour each day more than every one else, then we were going to be richer!". Some fishers were determined, above all else, to remain as one of the successful businesses in the industry regardless of the institutional changes that might be implemented. Comments such as, "we are in it to be successful", "we have much more business acumen than the average fishing family" and, "we plan to be one of the survivors-no matter what it costs", summarise the attitudes of these fishers. These fishers were involved in the fishing industry in order to make money, to maximise their profits, and to ensure that their business grew. They made a stark contrast with other fishers, who are best described as 'lifestyle fishers', who did not provide any indication that they were fishing in order to receive financial rewards.

The differentiation between 'profit-oriented fishers' and 'lifestyle fishers' is an important one when considering the influence of economic factors in influencing social resilience to institutional change. For example, economic factors could influence the level of interest that fishers had understanding institutional change. Many fishers believed that it was important to keep up to date with fisheries management in order to be competitive within the industry. These people made comments such as, "I like to know what is going on in the industry", "we have read everything there is to read about the Line Plan" and "I was so worried that I went to every single fisheries meeting that I could both north and south of Townsville". Often, the wives were more up-to-date than their husbands. In these situations, husbands would devote time to fishing whilst wives ran more or less every other aspect of the business including keeping up-to-date with changes in fisheries management. Keeping up-to-date with fisheries management, however, was difficult for many families with smaller businesses and especially for those whose wives (where they existed) did not take this responsibility. A common complaint was the expense and time incurred in travelling to meetings, or being on the phone with managers. Comments such as, "I want to get involved but who is going to pay the bills in the meantime?" or, "I wish I could get paid to spend time understanding the management-side better", best characterise these concerns. Many of the smaller-scale fishers felt that they were being discriminated against since larger companies could still be out fishing whilst, "the boss sits on the phone or flies down to Brisbane ensuring that their business is well looked after". Some fishers were very unaware of (e.g. "I didn't even know about the investment warning"), or cynical about (e.g. "things will be changed regardless of submissions and meetings"), the need to be aware of proposed changes in fisheries management. In these ways, economic factors could influence the level of preparedness that a fisher had in approaching generic institutional change.

Economic factors could also influence the ability of a fisher to successfully incorporate the requirements of institutional change into their fishing businesses. Fishers made comments such as, "to be resilient, you need extra cash to be competitive" or, "I spend too much time fixing my gear or my boat, when I should be out there fishing". Some fishers believed that they did not have the necessary skills to develop their business and survive future policy change, making comments such as, "I just can't see how I can get ahead". A few fishers refused to approach policy changes by entering into debt: a typical strategy employed by most fishers to incorporate change into their lives: "debt just means giving more money to banks- we have never had a debt". Such comments were made by smaller operators that were

typically struggling to keep ahead of their bills. They felt that they did not have the time or resources to do anything but continue fishing.

Although economic factors could influence the ability of a fisher to be resilient to institutional change, many small-scale fishers preferred to spend time in endeavours that they were familiar with, such as fishing and maintaining gear, rather than investing in the strategic development of their business. These 'lifestyle' fishers were not risk takers and did not have the confidence, knowledge or skills to compete with larger businesses. As a result, many lifestyle fishers survived on a relatively small income. Yet, although the economic incentives to remain within the industry were practically non-existent for many lifestyle fishers, most lifestyle fishers were deeply offended at the notion that they should be removed from the industry, since they were content to remain as they are. For example, one fisher said, "I am really offended that [a senior fisheries manager] thinks we are unviable and that he said he was doing us a favour by putting us out of business".

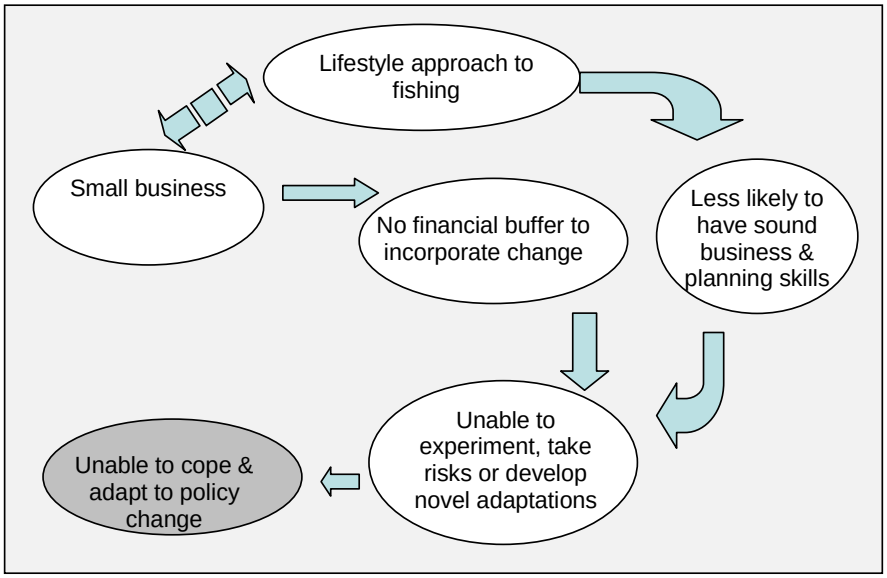
b. Interpretation of quantitative results and the influence of business size and approach on social resilience

Quantitative results showed that the business size and approach were highly correlated with a fishers' perception of their ability to plan and reorganise and their proximity to the threshold of coping. Qualitative results support this finding. Qualitative results suggested that fishers in larger-scale businesses were further from their thresholds of coping, and were sufficiently flexible to incorporate the requirements of policy change into their businesses and adapt. Fishers in larger businesses were more interested in developing creative ideas with which to meet the challenge of running a business, and were better skilled in approaching change. Small-scale fishers on the other hand, lacked the necessary skills to be competitive or to incorporate the requirements of change into their working lives. Small-scale fishers were also less likely to have sufficient financial resources with which to absorb the costs of change.

Figure 8.7 summarises how economic factors could significantly affect resilience to institutional change. It illustrates how fishers in smaller businesses tend to have a lifestyle approach to fishing. These fishers are less likely to have a financial buffer within which to incorporate the costs of change and they are less likely to have sound business and planning skills to successfully navigate through a change event. Fishers in larger businesses are more likely to have a 'business mind' since they employ other people and can devote time to

developing aspects of their business other than their fishing skills. Fishers in larger businesses can buffer themselves from unpredictable problems such as breakdowns, difficult crew and the weather. Small-scale fishers are less likely to be able to take risks, develop novel solutions and experiment with their options for the future. Small-scale fishers are thus less likely to be able to cope with change and adapt.

Figure 8.7. A summary of qualitative results: a mechanism to describe how business characteristics can significantly affect resilience to change.



8.3.3.2.6 Environmental factors

a. Describing the relationship with the environment

The relationship that fishers had with the environment was based on specific knowledge and skills that not only ensured success in obtaining income, but also meant that fishers could safely work in an unpredictable and dangerous environment. Fishers believed that until someone has demonstrated a commitment to understanding their practice through actual experience of the marine environment and the acquisition of necessary skills, they would never truly understand the relationship that a fisher has with the environment. [For these reasons, fishers believed that if fisheries managers spent at least some time at sea with them, then they would be more likely to design more appropriate and effective policies that reflect how fishers interact with their environment and would minimise social impacts. For example,

fishers made comments such as, "if only [he] would come out with me! They would respect us after seeing what we do".]

Some fishers clearly took pride in their knowledge of the ecology, biology and oceanography of the local area, whereas others did not believe it was necessary to know much more than 'how to fish' in order to be successful within the industry. Skill was a tremendously important aspect of the relationship with the environment. It encompassed cumulative knowledge of the environment and sometimes reflected a tradition of practice in which the trade of fishing required the devoted practice of skills. Trawl-fishers often liked to boast how other fishing boats would follow them because they were particularly good at locating prawns. Other fishers, on the other hand, described how skills and knowledge were not necessary in current times because of the introduction of specialised technology. In fact, some trawlers complained how anyone with enough money to buy the right equipment could easily earn an income from fishing. Several line fishers liked to describe how they knew where to fish in relation to a reef and the tides, and would watch other commercial or recreational boats fish in the nearby area, fail and move on. Some line fishers used 'viewing buckets', allowing them to see what was down there. Many emphasised how line fishing was not a highly developed technological endeavour but that it was carried out in, "more-or-less the same way as in 'biblical times' – where only a rod and line and hook is used".

Fishers often described their level of skill and knowledge by referring to the dangers of their occupation and their ability to deal with them. Safety was a strong motivator for fishers to quickly gain knowledge and skills. Fishers had a great amount of confidence in their ability to look after themselves and their crew. In the few circumstances that fishers had lost crew, they had taken the loss extremely badly. One wife explained how after much 'stress time' off, her husband finally went back to work only to call her every hour and tell her that, "[he couldn't] do this"-he kept on remembering "that night". Other fishers recounted how a trawler in the Innisfail region had recently gone down in the area, and no-one had any idea of where it was, or what was wrong. This seemed to unsettle many people and especially wives.

Inevitably, the relationship with the resource was also described in terms of the impact of fishing activities on the sustainability of the marine environment. Many fishers described their relationship with the environment in terms of their interest in issues of environmental sustainability. They made comments such as, "I am proud of my environmental ethic", and "I really care about the sustainability of the environment" or "I left trawling 15 years ago because

of the damage to the environment. Line fishing isn't like that". Many described their interest in the sustainability of the environment in terms of their own success, for example, "if the prawns are sustainable, then so am I!" Some fishers were worried about their ability to catch enough fish in the future because of over-harvesting by other commercial fishers. In particular, smaller operators were concerned that the bigger companies would continue fishing regardless of the weather and their activities would be thus mostly unregulated. For example, fishers made comments such as, "I am worried about the company-boats that stay out regardless of the weather. Up until now, mother nature has protected her own". Recreational fishers were also a major concern because they, "…don't have a feel for what has already been removed". A crabber was, "worried about the future of crabs. After the rain, it is mayhem, and no-one cares". Some fishers, on the other hand, were unsure of whether the fisheries resource was actually at risk in the first place since, "the natural fluctuations in the area are so huge that it is nearly impossible to tell whether the numbers of fish are reducing", "there isn't any worry about the sustainability of reef line species", and "I laugh at recreational fishers who say that there are no fish left".

Fishers were extremely aware of public perceptions towards commercial fishing. Line fishers that were interviewed in Cooktown described how the public openly grumble at the wharf about the "raping and pillaging" of the marine environment when they see the huge number of live trout cartons. They attributed this to the ignorance of the public since, until recently, reef line species were often filleted out at sea, so that when they came into shore, there were fewer cartons of fish to take off the boat, yet many more fish had been caught. Trawlers also believed that the broader community were misinformed as to their activities and impacts on the environment. Nearly all trawlers explained how they did not trawl 'on the reef' as was often suggested in the media, but rather in the inter-reefal areas in well-established trawl paths. They were also extremely keen to explain that the area trawled each night was on distance scales of hundreds of metres to few kilometres, rather than the many kilometres implied by the media. Several trawlers quoted a recent CSIRO report (http://www.publish.csiro.au/nid/22/pid/2419.htm) that stated that trawling in virgin territory could decimate up to 90% of the benthos, but that trawling in established trawl paths removed only around 10%. They also quoted how only 15% of the east coast of Queensland is now potentially trawl-able by demersal otter trawl gear (which makes up 95% of the trawl fleet) because of the nature of the seabed. Some were clearly upset that the public were unaware of these findings. One fisher took me on board his vessel so that I could appreciate

the sophistication of the technology they used. He insisted that it was possible to trawl in exactly the same place that they had trawled before, and that he could only operate in water of specific depth and topography.

The other major concern for trawlers was that of bycatch. Trawlers were aware that the broader community were mostly critical about levels of wasted bycatch. Some trawlers agreed, and believed that one solution was for them to be allowed to sell the bycatch component. Comments such as, "I cannot believe the silliness of the bycatch rules – they make wasters out of us" were typical. Other trawlers questioned how their activities could be unsustainable since every year the amount of bycatch was the same, and the volume of prawns was the same, even though they were trawling in the same trawl paths each year.

Some fishers described the special feelings they had for certain species as a way of describing their relationship with the fisheries resource. For example, one fisher believed that it was cruel to target Mahi Mahi (dolphin fish) since they mate for life. After I interviewed another family in Bowen, I interviewed the son who did not live too far away (and was also a fisher). He described how his father lost two of his fingers whilst they were netting many years ago to save a dugong that had become entangled in their net. Since it was clear that the boat was in danger of capsizing, the son offered to kill it. The father refused and subsequently lost two of his fingers that were caught in the net. The son reminded me how the general public think that fishermen do not care about dugong, an endangered marine mammal. Describing close encounters with marine wildlife seemed to be a way that fishers could demonstrate their 'intimacy' with the resource. One netter explained that when he was at high school he was a vegetarian, indicating that he had a special bond with animals, and that he now 'thanked' each animal that he caught in his nets. One shark netter described his fascination with the deep sea lice that could render a shark carcass empty save for its skin within hours. Interesting environmental phenomena such as coral bleaching, spawning, fish spawning aggregations and schools of fish larvae were also common topics discussed. For other fishers, the environment encompassed the wild variability in the weather, and the corresponding dependence of fishers upon it. Many recounted their near-death experiences as the result of sudden bad weather, and the sometimes tragic endings that resulted for their crew or friends. Overall, however, the relationship that many fishers had with the fisheries resource and marine environment was based on a keen and avid interest and perhaps even a 'love' of the natural marine world, where fishers were fascinated by what they saw and sought to observe and understand it.

b. Interpretation of quantitative results and the influence of environmental factors on social resilience

Environmental factors were not found to be statistically significant in influencing the response of commercial fishers to changes in fisheries policy. Nonetheless, qualitative discussions about the nature of the relationship provided some insight into the relationship that fishers had with the resource, and highlighted some of the frustrations that fishers had with the public and institutional arrangements that could restrict their ability to be resilient.

8.4 Discussion

Resource dependency hindered the ability of many commercial fishers in this study to cope with policy change and adapt. Fishers that were socially and economically dependent on the fisheries resource were inflexible: they lacked the necessary skills and the financial buffer to successfully navigate through a policy change period. Many fishers had developed a niche for themselves within society, which, for most of their lives, had provided stability and security, but faced with relatively recent changing institutional, social and environmental conditions, they have become vulnerable.

The factors contributing to vulnerability to policy change were complex. For many, it included an extraordinarily strong attachment to the fishing occupation which limited a fisher's flexibility to consider an alternative occupation. In extreme cases, fishers may be exhibiting a form of 'resource addiction' in which they are so attached to the fishing industry that they are unable to visualise options (Freudenberg 1992, Fisher 2001). Vulnerability also resulted from a low level of employability. Although employability is affected by external factors such as the number of opportunities within the broader community where older males are particularly disadvantaged, employability is also affected by internal factors such as a negative attitude to working elsewhere, a lack of transferable skills and an older age. The relatively old age of fishers within the study was a considerably major factor limiting their flexibility. The 'lifestyle' approach of many fishers, which tended to reflect a lack of generic business skills and no financial buffer, also increased the vulnerability of some fishers to policy change. Fishers with a 'lifestyle' approach were generally unable to experiment with their options for the future as a result, and were less likely to take risks. In sum, fishers that were unprepared for change, in that they did not have the necessary skills to develop novel solutions to incorporate and adapt to the requirements of change into their working lives (and be socio-ecologically resilient) or

to transform outside of the fishing industry were severely constrained in their capacity to be socially resilient.

These results suggest that, in combination with the observation that the financial status of a fisher was not a significant influence, and contrary to the literature which suggests that economic factors are of paramount importance (Humphrey 1994, Overdevest and Green 1995, Randall and Ironside 1996), social mechanisms were especially significant in influencing the capacity of commercial fishers to be resilient to changes in resource policy. This study did find, however, that components of social and economic factors were closely intertwined. For example, the attachment to the fishing occupation and the ability to secure employment elsewhere were closely correlated. It is likely that fishers are heavily attached to their occupation because they are well aware of the lack of alternative employment options that exist, and that if other job opportunities were made available, their level of occupational attachment might be different. Smith et al. (2003) working with commercial fishers in Florida describe how, for many fishing families, "fishing is 'in the blood.'" She similarly found that the, "second-, third-, and fourth-generation fishermen typically work all of their lives in seafood production, often do not complete high school, and are not trained for another occupation." Hence, whilst social variables might be important in influencing social resilience, their importance is only significant (in the context of this study) in combination with other (already specified) variables.

These results also reveal that some resilience attributes are unique to commercial fishers as opposed to other resource-dependent people. For example, the literature suggested that the attachment to the occupation is developed and reinforced by interacting with others within the profession both during working hours and outside of working hours. In the logging and mining industries, communication and association with peers are an important way to reinforce identity and attachment within the industry (Becker and Carper 1956, Carroll and Lee 1990, Freudenberg 1992). Results from this study, however, suggested that the basis for attachment to the industry is different for fishers. Fishers in this study were observed to prefer to keep to themselves as much as possible (although the situation may be different for crew (see Tunstall 1969, Salaman 1974). Other researchers have also found that the basis of the attraction to the industry is different within the commercial fishing industry (Poggie and Gersuny 1974). Poggie and Gersuny (1974), whilst conducting research aboard vessels in the Port of Galilee, observed that there was a 'virtual lack of verbal communication' among fishers. Collectively, these observations indicate that, although the level of interaction between

workers can be used to measure the level of attachment to the industry for some occupations (e.g. Carroll and Lee 1990) it is not such a good measure for the fishing industry, and therefore an unlikely predictor of social resilience.

Instead, this study found that if fishers do significantly interact with other fishers, then they tend to be relatives or well-established friends. In fact, in this study, 66% of fishers had at least one member of their family, such as a father, uncle, grandfather or brother, also in the industry. The fishing industry in other parts of the world also tends to be made up of numerous family members. For example, on Canada's Atlantic coast, 86% of fishers are related to other fishers and on Rhode Island's fishery a 'very high' number of fishers were related to other fishers (Poggie and Gersuny 1974). In these cases, the level of interaction with other fishers could act to reinforce attachment to the industry since fathers, grandfathers, uncles, brothers, and even sons can be significant influences in the lives of fishers (Poggie and Gersuny 1974). Poggie and Gersuny (1974) explain that sons of fishermen on Rhode Island frequently accompany their fathers on fishing trips from an early age, even missing weeks of school to go fishing. Workers in other industries such as the timber industry, in contrast, have been found to have more kinship solidarity with the maternal side of the family (Poggie and Gersuny 1974). These results suggest that an important factor contributing to the attachment that a fisher has to the occupation is the number of family members, especially male members of the family, rather than friends, within the industry.

An important consequence of these observations is that fishers that were excessively independent became attached to the industry because of the work and became vulnerable to institutional change as a result. In contrasting the attitudes of fishers with mill-workers in reference to the level of attachment to their respective industries, Poggie and Gersuny (1974) found that while mill workers worry more about 'losing their wives than about losing their jobs', fishermen tend to worry more about 'losing their boats than losing their wives'. Fishers are attracted to the fishing industry in the first place because of the opportunity to work without regimentation and free from the influence of others. Only excessively independent personality types could withstand and thrive within the unconventional and challenging work environment of the commercial fishing industry. This attraction may be one of the industry's greatest strengths. Yet, because such personality types are likely to become excessively attached to the industry, in the face of environmental, social and institutional change, this quality is perhaps also one of their greatest weaknesses.

Thus, the basis of attachment of fishers to their community is not, as the literature suggests, the links with friends and community networks (e.g. Fried 1963, Amerigo 1997, Flora 1998, Fried 2000), but rather with children and grandchildren. Divorced fishers are attached to their community because they are reluctant to move elsewhere since they would see their children even less frequently. Grandfathers with grandchildren living close-by want to enjoy being with their grandchildren, especially if they have missed out on their own children growing up. The extent of this attachment can preclude their will to consider moving and living elsewhere. These results suggest that community attachment could influence social resilience by reducing the flexibility with which commercial fishers can chase income opportunities, however, the level of attachment to the community on social resilience was not statistically substantiated, and possibly because the sample size used in this study was too small to adequately represent each of these groups.

Understanding that some 'lifestyle' fishers are content to remain as small-scale fishers is important in understanding why some fishers respond to policy changes negatively. 'Lifestyle' fishers could improve their financial situation by borrowing money to invest in, and expand the earning potential of, their business. However, while borrowing money to invest in a business may increase earnings, the associated debt can increase their sense of financial vulnerability. This can be a particularly strong disincentive for people who prefer to remain independent (of financial organisation). As Chambers (1989) observes, refusing to increase vulnerability by taking out a business loan enables small-scale fishers to ensure security and independence in the best way they can. Although 'lifestyle' fishing families may not be planning a plentiful future for themselves, they are mostly satisfied with their life choices, where their aspirations are oriented elsewhere than financial rewards (such as lifestyle, independence and self-respect) (Chambers 1989). Several other researchers working in resource-dependent communities have also shown that some people prefer independence in their working lives over the opportunity for higher income (Daniel 1988, Lane and Rickson 1997, Bliss et al. 1998). This knowledge can assist in the design of management strategies that aim to maintain social resilience of industry members.

Results also indicate that, for many fishers, the time spent at sea developing knowledge and skills, has fostered a genuine interest in the marine environment which frequently translates into a strong attachment to the occupation. Although a strong attachment to the occupation has been correlated with a lower resilience to change, qualitative results also suggest that fishers that have an avid interest in issues of sustainability might also be more likely to be

resilient to policy change because they are more likely to be aware of the need to implement strategies to better protect the sustainability of the resource. Researchers working in agricultural regions in Australia have shown that farmers involved in community-based land management (e.g. 'Landcare') are also more likely to have successful businesses because they are aware that an interest in the condition of the environment is paramount to being able to cope with it changing (Curtis and De Lacy 1996, Curtis et al. 1999, Curtis and Van Nouhuys 1999, Walters et al. 1999).

These results can be used to better understand how fishers at an industry or community level might respond to policy change and adapt. An examination of the effect of resource dependency at an individual level has unmasked the underlying mechanisms influencing social resilience within a diverse resource industry. For example, fishers tended towards either a 'lifestyle' or 'business' approach; many fishers were very attached to the industry, whereas others were quite keen to leave the industry; some fishers earned very little income from the industry, whereas others earned a considerable amount; other fishers were sole operators, whereas others owned larger companies employing a larger number of crew and other staff. Why some individuals were differentially resilient to generic policy change can be explained on the basis of their dependency on the fisheries resource. The examination of individual resilience to policy change has meant that the mechanisms maintaining, eroding or enhancing resilience are revealed. With the same approach that Folke et al. (2002a, b) suggest to enhance social resilience at a community level, community-level resilience can also be enhanced using structured scenarios specially adapted for specific individual categories on the basis of the results obtained from this study. Knowledge of the factors that limit individual resilience may assist to develop more sophisticated structured scenarios. For example, knowing that attachment to the occupation and a low employability are likely to result in a low capacity to be resilient, a possible structured scenario might involve strategies to successfully remain within the industry or to identify attractive and alternative occupations. Structured scenarios that are even more progressive and appropriate can be further developed knowing that lifestyle fishers with a small fishing business are likely to be especially unable to cope with policy changes and adapt.

8.4.1 An operational model of the influence of resource dependency on social resilience

This study represents an attempt to quantify and understand the practical implications of altering the nature of the relationship between resource-users and a natural resource by policy

change. A conceptual model developed in chapter 3 proposed that social resilience could be affected by policy change through psychological impacts, increased poverty and resource addiction if the level of social, economic and environmental benefits obtained from the resource were altered. Results from this chapter show that only social and economic factors were important in influencing social resilience (figure 8.8). The important social factors are the combined effect of employability and level of attachment to the industry (E). The important economic factors are the combined effect of business size and approach (F). Social and economic components of resource dependency can affect the perceived proximity to the thresholds of coping. Social factors can also affect the perception of risk associated with policy change (D). Economic factors can affect the ability to plan, learn and reorganise (D). Qualitative results suggested that other components of resource dependency such as family circumstances, place attachment and specialisation might be important in more complex ways than could be investigated in this study. Generally, however, factors lending towards the development of social capital at an individual level such as place attachment and the nature of attachment to the fishing industry were not observed as being significant influences on social resilience for the commercial fishing industry. This result suggests that whilst social capital, or the strength of supportive networks with others in the industry and community, may be important for other resource-dependent communities, unique characteristics of commercial fishers make it less important within the fishing industry at an individual level of analysis.

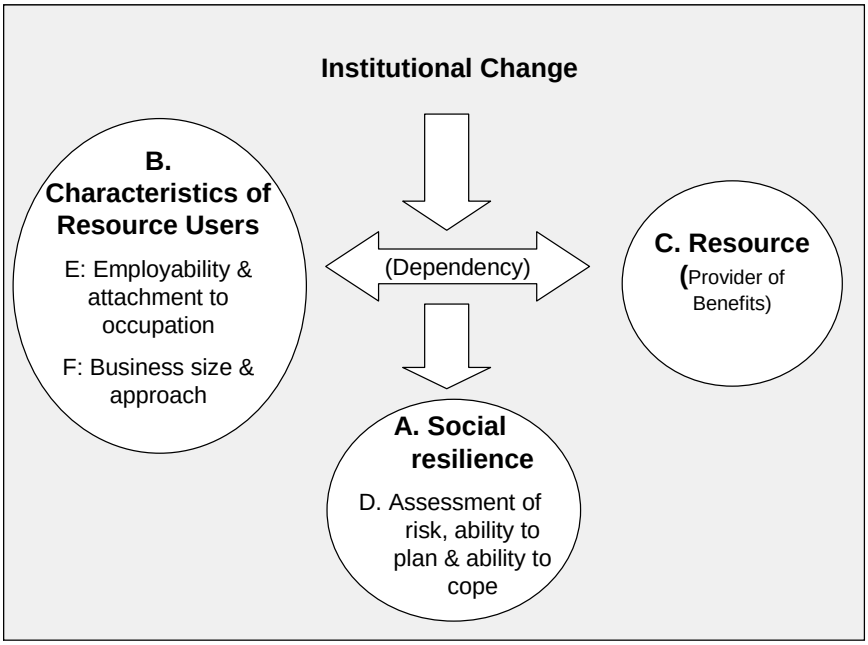


Figure 8.8. An operational model of the influence of resource dependency on social resilience.

Chapter 9. Results III.

9

The Influence of the Perception of Policy Design & Delivery on Social Resilience

"If we ask a man who is exploiting a commons to desist "in the name of conscience," what are we saying to him? What does he hear? -- not only at the moment but also in the wee small hours of the night when, half asleep, he remembers not merely the words we used but also the nonverbal communication cues we gave him unawares? Sooner or later, consciously or subconsciously, he senses that he has received two communications, and that they are contradictory: 1. (intended communication) "If you don't do as we ask, we will openly condemn you for not acting like a responsible citizen"; 2. (the unintended communication) "If you do behave as we ask, we will secretly condemn you for a simpleton who can be shamed into standing aside while the rest of us exploit the commons."
"The Tragedy of the Commons," Garrett Hardin, Science, 162(1968):1243-1248.

9.1 Introduction

Social resilience depends, to an uncertain extent, on the institutional context within which people live and work (Adger 2000). What the specific components are, however, are mostly only surmised. In chapter 4, many components of the institutional context within which resource-dependent people are embedded, were identified as potentially able to directly influence social resilience. These included the anticipation of impacts, the rate of implementation, the perception of equity, as well as the quality and quantity of involvement in the decision-making process. Although many features of institutional change are likely to influence social resilience, the perception of institutional change by resource-users was identified as being a particularly important influence, since researchers such as Gramling and Freudenberg (1992) and Sekhar (2004) have pointed out that the anticipation of impacts can be just as real as actual impacts. Researchers such as McCay (1996), Burdge (1990), Butler (2001) and Jiggins and Powell (Jiggins and Powell 1999) have also pointed out that resource-users are in the best position to assess what the likely impacts are likely to be, and hence their perception of the likely consequences of policy change are the main interest of this study. People with a negative perception of policy change were expected to be less resilient to policy change because they were expected to feel less secure and confident in the future. However, whether any of these components can significantly influence social resilience has not been

directly examined. Identifying which components act to influence social resilience may improve our understanding of the causal mechanisms that maintain social resilience.

The aim of this chapter is to test whether a significant relationship exists between how policy change is perceived and social resilience. A fisher's perception of policy change was assessed using standard survey techniques. Survey questions were presented to 100 commercial fishers in five communities in North Queensland. The perception of policy change was then correlated against the four components of social resilience identified in chapter 7 and results were validated and interpreted using qualitative data. The results were expected to refine the conceptual model of social resilience (developed in chapter 5).

9.2 Methods

The same 100 commercial fishers that took part in the broader survey examining social resilience and resource dependency (chapters 7 and 8) were also surveyed to assess their perception of policy change and its influence on social resilience. Survey statements were designed to quantify the perception of the involvement in the decision-making process, the interpretation of policy change in terms of its effectiveness, equity and anticipatory impacts, and the perception of the rate of implementation. These conceptual variables were identified on the basis of the literature, scoping study and conceptual model (chapter 5) as being characteristics of policy change that were potentially important in influencing social resilience. Responses were required in the form of a 4-point Likert scale; ranging from 'strongly disagree' to 'strongly agree'.

An initial version of the survey was pilot-tested with 15 fishing families in Townsville, as described in chapter 6. The final version of the survey (see appendix) was administered to 100 commercial fishers in five coastal communities in North Queensland as also described in chapter 6. A reliability analysis was used to ensure that only those statements that contributed to the internal consistency of the scale for policy involvement, interpretation and implementation were included (Zeller and Carmines 1980, Spector 1992, Chen and Popovich 2002). A Cronbach's alpha of 0.7 or greater was accepted as indicating a reliable scale (Nunnally 1978).

Once the scales assessing policy perception were established, the mean perception of policy change (for implementation, interpretation and involvement) was calculated for each

respondent. These values were then subjected to a Principal Components Analysis (PCA) in order to operationalise the concept of policy perception for the commercial fishing industry in North Queensland (Kim and Mueller 1978). A PCA was expected to identify the main components of policy perception with minimal correlation between them (Zeller and Carmines 1980, Tabachnick and Fidell 1996). On the basis of the PCA, each respondent was assigned a factor score to represent their perception of policy change for each scale. A factor scale is a composite measure (like 'mean') that reflects the relative weighting of each statement in producing the scale.

In order to assess the significance of policy perception on each of the four dimensions of social resilience (as identified in chapter 7), a Pearson correlation was conducted between (i) the factor scores representing policy perception and (ii) the factor scores for each of the four components of social resilience identified in chapter 7. A Pearson's correlation coefficient is a measure of the strength and direction of the linear association between the independent and dependent factors. A Pearson's correlation allows an assessment of the likelihood that each independent variable is a predictor of the dependent variable. An alpha level of 0.05 was used to assess the significance of each relationship (Underwood 1997). The relationship was also examined graphically in order to maximise the accuracy of interpretation.

Qualitative data were collected as described in chapter 6. Qualitative data were collected in order to identify the possible causal mechanisms (i.e. how the perception of policy change could influence the dependent variables) and to assist in the interpretation of the quantitative results (Beckley 1995, Smith 1995, Beckley 1998). Briefly, interview summaries for each of the 100 participants were constructed from the semi-structured qualitative interviews. A Content Analysis was used to analyse the data (Weber 1985, Stemler 2001). 'A priori' keywords such as the 'quality of involvement in the decision-making process', 'interpretation of equity', 'interpretation of rate of implementation' and 'interpretation of conservation effectiveness' were used, although several other keywords were also used after an initial examination of the data. Key words were used to analyse the presence, meanings and relationships of words and concepts within texts (Weber 1985). Conceptual links were made between the variables and patterns identified (Henderson 1994). Simple flow diagrams were constructed to summarise the findings of the analysis.

9.3 Results

9.3.1 Developing the scale for policy perception

Table 9.1 presents the descriptive statistics and results of the reliability analysis for each of the survey statements used to measure the perception of policy change. Statements were measured on a 4-point scale ranging from 1=strongly disagree, 2=disagree, 3=agree to 4=strongly agree unless otherwise specified.

Table 9.1. Descriptive statistics and reliability analysis on the statements designed to quantify the perception of policy change

Survey items	Mean	SD	Item-total correlation	α if item deleted
Involvement in the decision-making process. $\alpha = 0.701$				
How regularly do you attend fisheries meetings each year?**	1.217	.415	.362	.630
Are you a member of a Local Management Advisory Committee (LMAC)?***	1.797	.405	.272	.638
Do you know anyone sitting on a Management Advisory Committee?***	2.782	1.082	.338	.619
How well do you know the QSIA branch chair-person for your area?****	2.289	.729	.292	.629
There have been too many changes in the industry over recent years*	1.869	.968	.268	.632
Changes imposed are introduced in the best interests of the industry*	1.797	.850	.223	.639
I feel that I am unable to influence the decisions made by managers*	1.608	.911	.340	.619
I like to get involved in with the political side of the fishing industry*	2.405	1.167	.446	.593
I have a good relationship with fisheries managers	2.449	1.036	.348	.616
Public meetings are a useful way to receive information about proposed changes	2.695	1.061	.157	.656
Implementing change is difficult and I think that it is done as well as possible	1.869	.906	.241	.637
I feel I have personally been able to influence fisheries decisions in the past	1.623	.841	.333	.621
Interpretation of policy change $\alpha = 0.700$				
Big fishing companies will be the only ones able to survive future changes*	1.678	.882	.192	.715
Queensland has the best managed fishery in the world	1.896	.976	.332	.684
GBRMPA have a good vision for the future of the Marine Park	1.781	.841	.477	.645
QFS have a good vision for the future of the industry	1.517	.804	.520	.636

Survey items	Mean	SD	Item-total correlation	α if item deleted
I usually agree with the reasons that changes are introduced	2.137	.942	.394	.666
I feel like I am being made to leave the industry as quickly as possible*	1.781	.932	.569	.616
I would say that I have been significantly affected by previous changes*	1.655	.886	.388	.667
Rate of Implementation				
New changes in the industry are introduced with plenty of time to get organized	1.585	.781		

Notes: (*) The data for negative worded statements were reversed prior to analysis
(**)Measured on a 4 point scale ranging from 0, 1-2, 3-, 6+ per year
(***) Measured on a 2-point scale (1=no and 2=yes)
(****) Measured on a 3-point scale from not at all, a little, very well

Each respondent was given a mean value for each of the scales for policy perception (interpretation, involvement and implementation) based on the results of the reliability analysis above. Mean values were subjected to a Principal Components Analysis (PCA) and the results are presented in table 9.2. The results of the Principal Components Analysis (PCA) suggested that the perception of policy change was best described by one component, explaining 55% of the variation. The factor scores for the component (for each respondent) was saved and used to represent 'policy perception' for each respondent.

Table 9.2. Principal Components Analysis on policy variables

Statements	PC 1: 55.54%
Interpretation	.852
Involvement	.695
Implementation	.675

Note: PC =principal component

9.3.2 The influence of policy perception on social resilience

Table 9.3 shows the results for the correlation between (i) the factor score for the perception of policy change and (ii) each of the factor scores for each component of social resilience identified in chapter 7. Results suggest that the combined effect of policy interpretation, involvement in the decision-making process and perception of the rate of implementation was significantly and positively correlated with the first and third dimension of social resilience: the assessment of risk and the perception to the thresholds of coping.

Table 9.3. Results of the Pearson Correlation matrix examining the relationship between (i) the factor score for the perception of policy change and (ii) each of the factor scores for each component of social resilience identified in chapter 7.

Resilience Components:	**Y1: Risk**	**Y2: Planning**	**Y3: Coping**	**Y4: Interest**
Policy perception (implementation, interpretation and involvement)	.239*	-.001	.344**	-.041

Notes * Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

9.3.3 Interpretation of the influence of policy perception on social resilience

9.3.3.1 Graphical interpretation

Since the combined effect of policy involvement, interpretation and implementation was regarded as complex, it was broken down into more basic units so as to accurately interpret how policy perception could influence social resilience. The factor scores for the independent factors were recoded into categorical data so that any relationship could be visualised more clearly. The significance of the relationship was assessed (on non-categorical data) using a Pearson correlation analysis.

Figure 9.1 suggests that fishers that positively perceive the rate at which policies are implemented (using the example; "new policy changes are introduced with plenty of time to get organised") were more likely to positively assess their ability to plan and reorganise, as well as more positively assess their ability to cope with the change, compared to fishers that negatively interpret the rate of implementation of policy. These relationships are, however, statistically insignificant.

Figure 9.2 suggests that fishers that negatively anticipate the impacts of policy change (using the example; "I feel as if I am being made to leave the industry as quickly as possible") were significantly more likely to negatively assess the level of risk associated with the change and their ability to cope.

Figure 9.3 suggests that fishers that positively assess the effectiveness of policies in meeting conservation goals (using the example; "I think that Queensland has the best managed fishery in the world") were more likely to negatively assess the level of risk associated with policy

change and are more likely to positively assess their ability to cope with the change. These relationships are, however, statistically insignificant.

Figure 9.4 suggests that fishers that have a high level (quantity) of involvement in the fisheries decision-making process (as assessed using the example; "How regularly do you attend meetings each year?") were significantly more likely to negatively assess the level of risk associated with policy change and are (not significantly) more likely to positively assess their ability to cope with the change.

Figure 9.5 suggests that fishers that feel as if they are meaningfully involved in the decision-making process were more likely to respond positively in their assessment of risk and in their ability to cope. These relationships are, however, statistically insignificant.

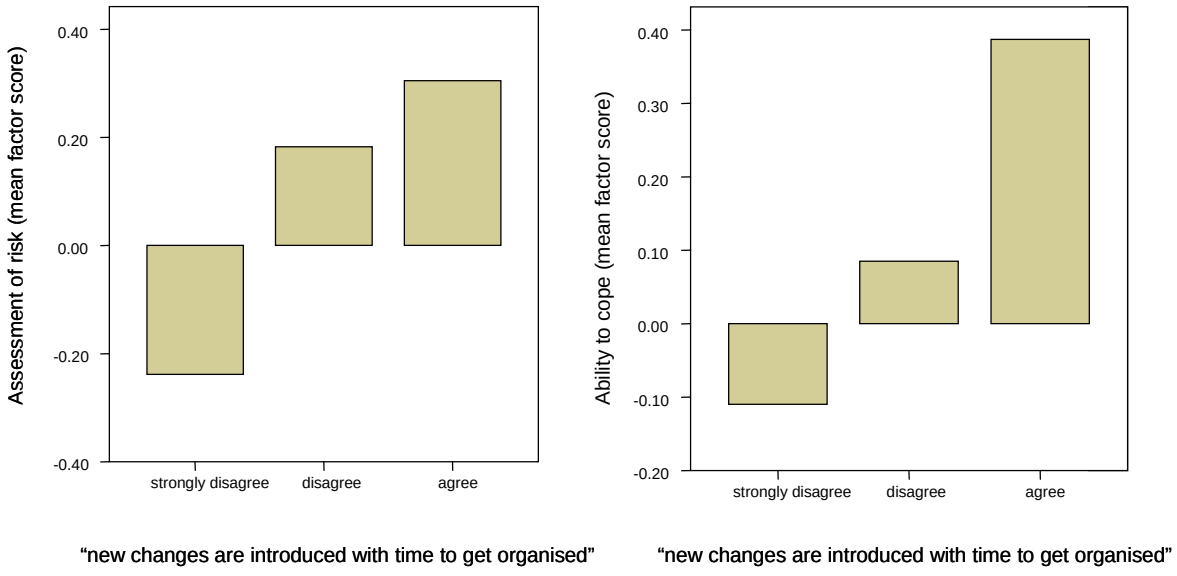
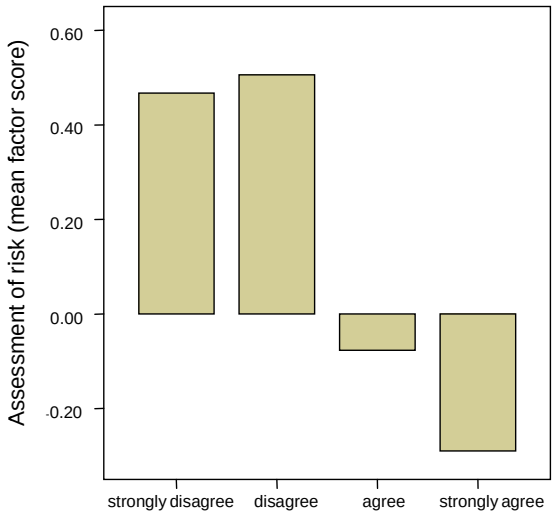


Figure 9.1. Direction of influence of policy implementation (using the example; "new policy changes are introduced with plenty of time to get organised") with (i) the assessment of risk (Pearson correlation= .183) and (ii) the ability to cope (Pearson correlation= .164).



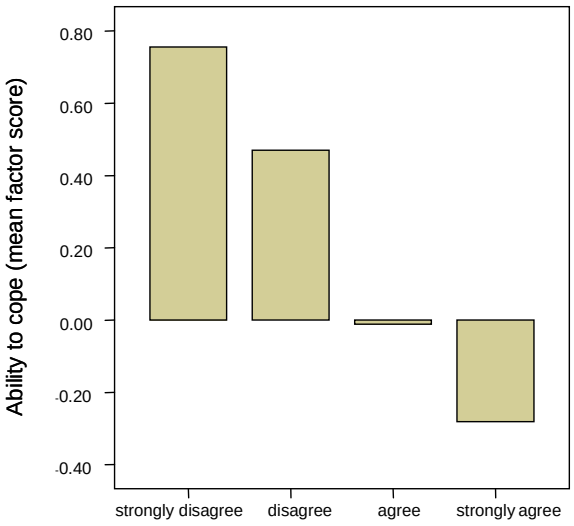
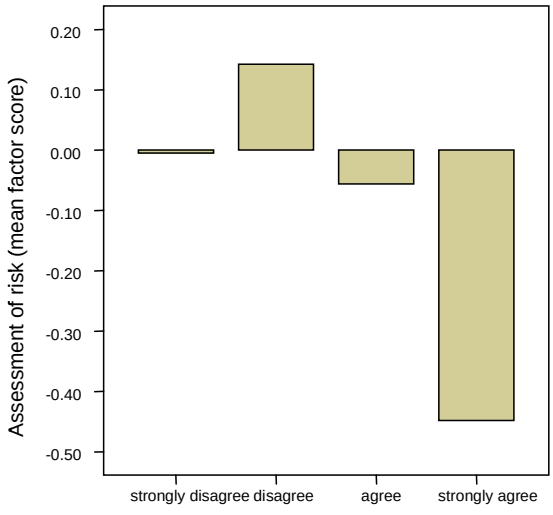


Figure 9.2. Direction of influence of the interpretation of anticipatory impacts (using the example; "I feel as if I am being made to leave the industry as quickly as possible") with (i) the assessment of risk (Pearson correlation= -.326; significant at the .01 level) and (ii) the ability to cope (Pearson correlation= -.342; significant at the .01 level).



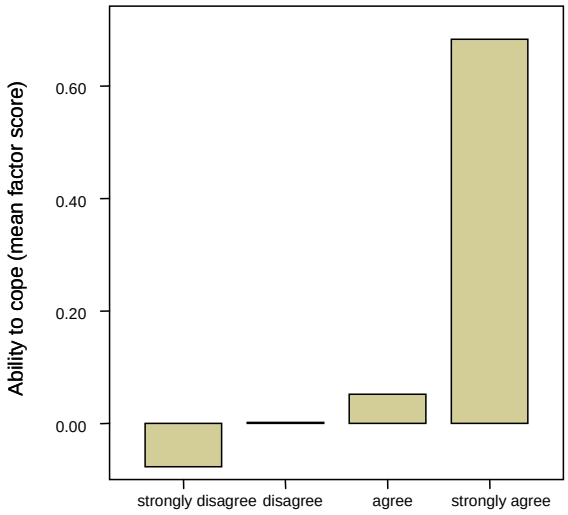


Figure 9.3. Direction of influence of interpretation of the ability of policy change to effectively meet conservation goals (using the example; "I think that Queensland has the best managed fishery in the world") with (i) the assessment of risk (Pearson correlation= -.073) and (ii) the ability to cope (Pearson correlation= .153).

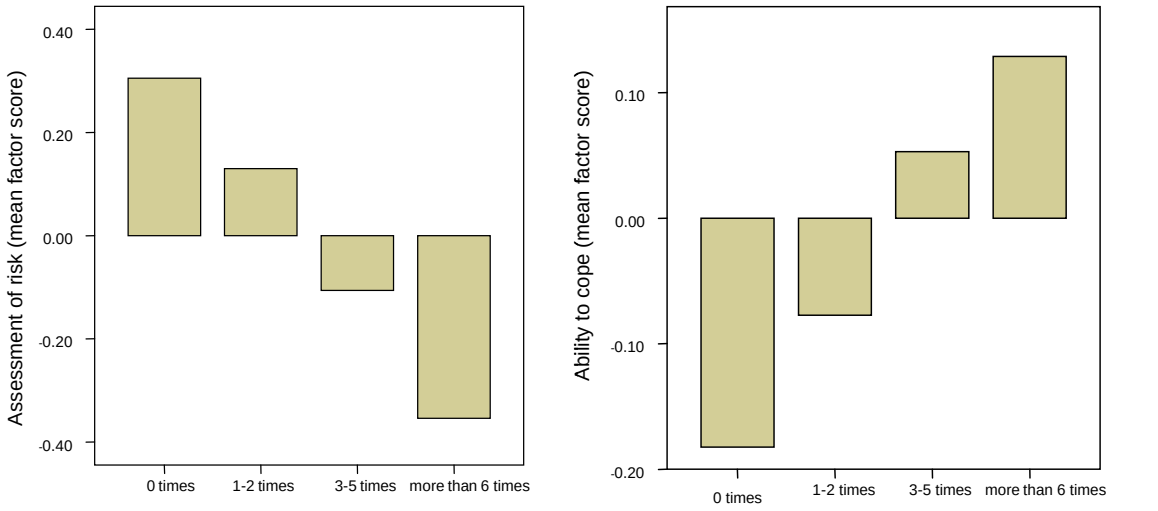


Figure 9.4. Direction of influence of the quantity of involvement in the decision-making process (using the example; "How regularly do you attend meetings each year?") with (i) the assessment of risk (Pearson correlation= -.253 which is significant at the .05 level) and (ii) the ability to cope (Pearson correlation= .108).

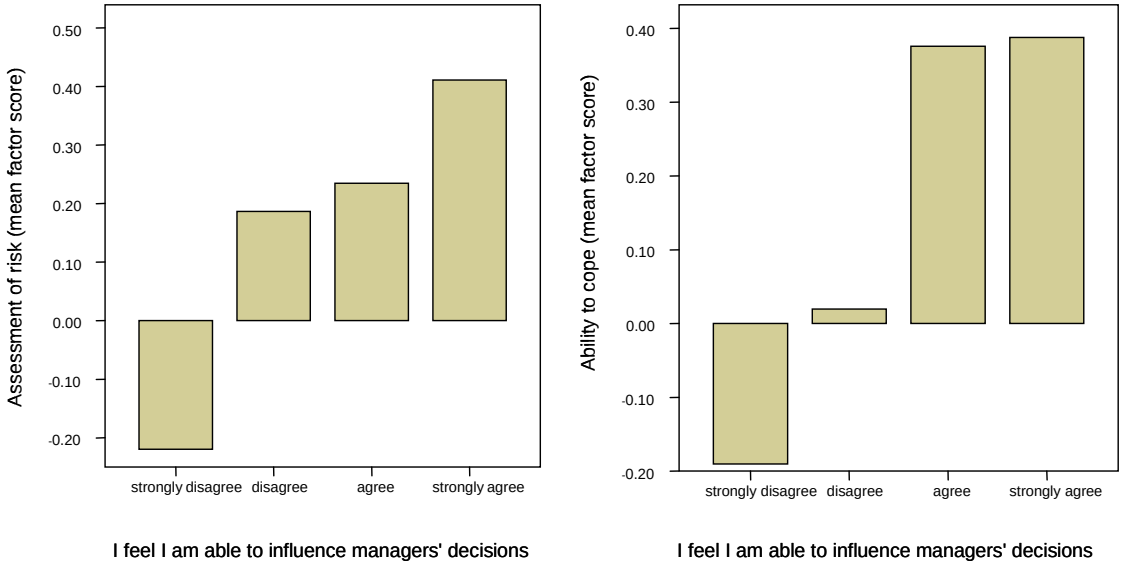


Figure 9.5. Direction of influence of the quality of involvement in the decision-making process (using the example; "I feel that I am able to influence manager's decisions") with (i) the assessment of risk (Pearson correlation= .150) and (ii) the ability to cope (Pearson correlation= .154).

9.3.3.2 Qualitative Results

In this section, qualitative data are examined to (i) provide greater understanding of how the response of fishers might be influenced by the perception of policy change and (ii) to identify the likely mechanisms influencing the response. Flow diagrams are used to summarise the findings.

9.3.3.2.1 Involvement in the decision-making process

a. Describing the nature of involvement in the decision-making process

A small number of fishers were involved in the decision-making process as fishery representatives in committee meetings called Local Management Advisory Groups (LMACS), Reef-line Management Advisory Groups (ReefMAC), or Trawl Management Advisory Groups (Management Advisory Groups). These committees are set up by the state government fisheries management agency (Queensland Department of Primary Industries and Fisheries QDPI&F) and include representatives from the Great Barrier Reef Marine Park Authority (GBRMPA). Their role is to assist in the fisheries management process. Fishers that sat on the LMACs were usually the branch chairs for the industry association for fishers, the Queensland Seafood Industry Association (QSIA). Each of the major regional centres along the Queensland coastline has a branch. These fishers were generally well-connected to other fishers within their region, however some fishers felt that their interests were in direct competition with the representatives and did not see the point of associating with their industry representative. One representative told me that he thought that other fishers in his region "resented" him for his role on the advisory committees.

For most fishers, however, involvement in the decision-making process meant attending community fisheries meetings that were held anywhere between 1-6 times a year in each community, depending on the issues to be resolved. In sum, fishers mostly explained that fisheries meetings were, "a waste of time". Because fishers frequently felt inarticulate and nervous speaking in front of their peers and resource managers, they felt that they often made a "fool" of themselves. They could not express their point of view without getting frustrated and raising their voice. They knew that decision makers would not take them seriously if they "ranted and raved", but fishers explained that "on the spot" they could not find the words, or even the argument sometimes, to sway the bureaucrats to properly consider their situation.

One fisher explained how his wife no longer allowed him to go to meetings because he could not sleep for, "at least one week, and sometimes three after each meeting". During the meetings he did not feel "clever" enough to come back with the appropriate words to convince decision makers to change their plans. Instead he would say "silly things", and spend the following nights awake and thinking of all the things that he could have said. These qualitative results reinforce the findings of the quantitative results which suggested that the level of involvement in the decision-making process could have a negative impact on the response of fishers to generic policy change, and on social resilience.

Fisheries meetings were commonly referred to as, "the battle zone" between fisheries managers and commercial fishers. Managers were mostly described as a "bunch of bullies" and in many instances as naïve (e.g. "managers do not understand the impacts of their decisions"). Fishers frequently also referred to the patronising behaviour of managers who believed that they were, "in charge of rescuing the Great Barrier Reef" from the activities of commercial fishers. Fishers made comments such as, "managers treat us like we don't even know what sustainability is!" and "they make it seem like they have saved the resource and environment. We deal with a living resource and environment. Why don't these people listen? We are not idiots". Similarly, "it exasperates me to think that the GBRMPA think that they are in charge of protecting the GBR". Subsequently, the relationship between fishers and resource managers is based on distrust. Many fishers believed that, "the [strategy] is corrupt"; "simply, managers are outright liars", "they used the logbooks to crucify us", "we don't have the power to control our own lives" and on the back of one survey a fisher wrote, "no one wants the ideas of fishermen. It is expedient for agencies to trot out the scientists to condone forthcoming changes and dismiss any ideas from the fishing community which in return leads to mistrust, inaccurate catch reporting and a raft of other problems".

The relationship that developed between the groups, as result of fisheries meetings, was emotional and personal. A large number of fishers had met a senior representative from the Queensland Fisheries Service (QDPI&F) (referred to here as #1) and the Great Barrier Reef Marine Park Authority (GBRMPA) (referred to here as #2) and held each of them personally responsible for various aspects of current fisheries management legislation. At the time of the interviews, the Line Plan had been proposed but not as yet implemented. #1 was effectively responsible for the design of the plan. Many fishers wanted to express their frustration at the plan by personally threatening #1 (for instance, "tell [#1] that he will be sorry if he goes ahead with the Line Plan", "if I won $1 million, I would spend $200,000 to make sure that [#1]

spent the rest of his life behind bars" and, "if the Line Plan goes through, then I am taking my six kids to Brisbane to live with [#1]. He can have the responsibility of feeding them!"). There were also several accounts of inflammatory comments made by #1 to fishers such as, "[#1] said that he would more likely look after the bigger guys, because they were more likely to sue him than the little ones", and "I am really offended that [#1] thinks we are unviable and that he said he was doing us a favour by putting us out of business".

Perhaps one of the more common accusations regarding #1 was that, at a personal level, he seemed to care and would give advice to fishers. Once the Line Plan was proposed it became apparent that his advice was wrong, and that people's lives were significantly impacted upon as a result. However, he had no memory of giving such advice and refused to take responsibility. For example, "[#1] told us L2 licences were sacred, so we bought one", "[#1] has given us wrong advice, and now our lives are ruined" and, "[#1] told us we would not be affected". One woman showed me a letter she wrote, but had not yet sent, since she did not know to whom to address it. Within it, she wrote, "'Is there not enough warmth in [#1]'s work environment, or is he really so averse to inflicting suffering and hardship on various fishermen and their families, that he is compelled to offer this unsought and as it turns out unreliable advice as some form of olive branch down the telephone wire to me? Or perish the thought; was this deliberate mischievousness, brought about by stress from the pressure to produce such a heartless plan? Or does it take a heartless man to produce a heartless plan?" Another man demanded, "I want the word, FAIRNESS, written above [#1]'s desk!" These results further reinforce the quantitative results that equity, interpretation and level of involvement in the decision-making process are highly correlated and interconnected.

Equally distressing to the trawl fishers was #2 of the GBRMPA who was largely responsible for the design of the trawl plan. He lost respect of many trawlers at one community meeting where he apparently threatened that he "…would be the industry's worst nightmare". He was regarded as "…serving a personal agenda", even though in the media he portrayed himself as, "trying to do the best job he could for the environment". Others admitted that #2 spoke "above [their] heads" and was generally not understood. In the words of one older fisher, "[#2] may have been telling the truth or he could have been lying, but the thing is, we just didn't understand him".

b. Interpretation of quantitative results and the influence of involvement in the decision-making process.

Quantitative results suggested that the level of involvement in the decision-making process could have a detrimental effect on social resilience whereas quality involvement could have a positive influence. Qualitative results supported these findings. Fishers that felt that they had a meaningful involvement in the policy process were probably those fishers that were involved in the advisory committees (LMACs). Inevitably, these fishers were generally more positive about generic change because they understood the need for it (e.g. "they should have done something earlier" and, "we told them ages ago that we needed better legislation"). They felt that they were able to influence the decision-making process to some extent, which gave them confidence in the future of the industry (e.g. "it's about time that the [strategy] is implemented). Fishers that were confronted with the "battle-zone", in the form of community fisheries meetings, were negative in their perception of the future and their proximity to the thresholds of coping because they felt that they did not have the opportunity to contribute to the decisions that were being made about their future, did not feel respected and did not trust that decisions were being made in the best interest of the industry as a whole. In summary, figure 9.6 provides a mechanism, based on the qualitative data collected, proposing how social resilience (the ability to cope and adapt) might be influenced by the quality of involvement in the decision-making process.

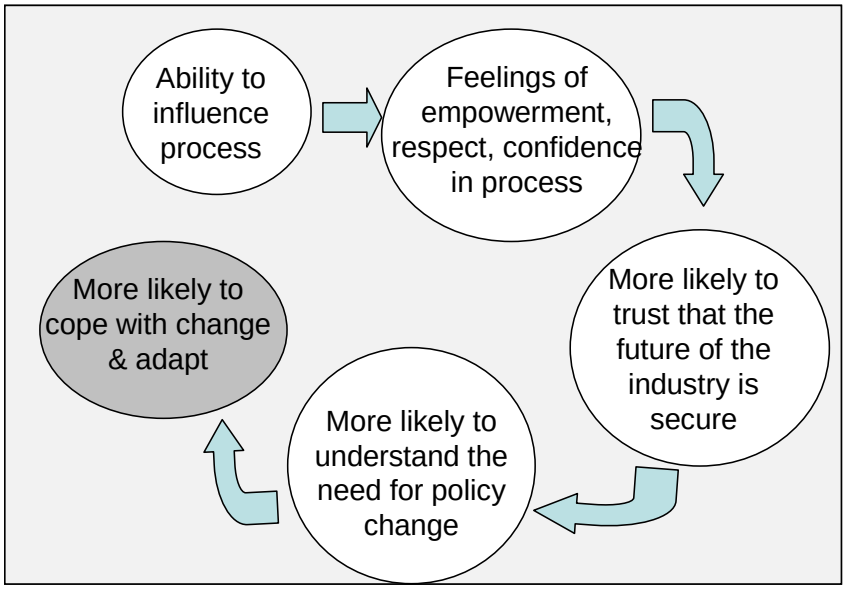


Figure 9.6. A summary of qualitative results: a mechanism describing how the quality of involvement in the decision-making process can significantly affect resilience to change.

9.3.3.2.2 Interpretation of institutional change

a. Describing how institutional change is interpreted

Policy change was interpreted in two main ways: (i) the anticipated impact on fishers and their families, which included the level of equity and rate of implementation, and (ii) their effectiveness in protecting the fisheries resource. In the first instance, fishers often interpreted new policies as drastically compromising their options for the future. For example, fishers made comments about past and proposed policy changes in order to illustrate their position regarding generic policy change, such as, "the Line Plan is going to have a major impact on me and my family", "hearing about the Line Plan nearly killed my husband", "we have spent 10 years building up our business. I couldn't bear it if that was taken away," and "I want to end my career as if I haven't lost". Past experience influenced how people interpreted proposed policy changes. Fishers affected by the Trawl Plan made comments such as, "the trawl plan meant that we were forced out of the industry after 27 years", "we have been put back financially many, many years", "the trawl plan cost me $600,000", and "we have had some very hard times because of the trawl plan". Fishers affected by the ban on ring-netting made comments such as, "I knew they would restrict me – but I didn't consider that they would stop ring-netting altogether! This has had a huge impact on me". Some people, however, did do very well out of new policies. One family described the Trawl Plan as "having removed the competition", and for this reason, saw changes in fisheries policy as an opportunity rather than a threat.

Overwhelmingly, policies were interpreted as being unfair or immoral. Fishers made comments such as, "I have been treated unfairly and illegally", "I have been so unfairly affected – so you can imagine how much I hate bureaucrats", "they try and do good, but really all they are doing is making some people richer, and other people poorer", and "the unfairness really upsets me". Fishers believed that others were going to do better than them; and others were not as deserving. For example, "the people who lie, or overuse the resource, are being rewarded" (referring to logbook history as the basis of deserving future allocation rights) and, "as with the spanner crab industry, the new policies just help the big guys elbow out the little guys".

Policies were rarely interpreted as protecting the environment. Fishers made comments such as, "even if the numbers of fishers are reduced, it does not mean that the numbers of fish

caught will be reduced" or, "the same amount of effort is there, but now just pushed around". Decision-makers were regarded as being "out of touch" with fishers' issues, activities and behaviours. At best, policies were interpreted as ineffective. For example, "I just don't see how management is trying to preserve fish stocks with their policies", "managers don't realise how silly their policies are-they do not protect the environment at all" and, "they [managers] have no idea how to ensure the sustainability of the fisheries". At worst, policies were interpreted as having nothing to do with the protection of the environment and that, "management push a political agenda rather than a sustainability one", "managers are not out to protect the environment. You can tell since some people do really well out of their policies", and (as written on the back of one survey), "the proposal for allocation of effort could be classed as the world's worst fisheries management in that it promotes short term maximum effort, compromise rules for safety at sea, penalise low impact lower effort fisheries and probably cause a large overrun in total allowable catch."Some fishers believed that policies actually promoted the accelerated degradation of the resource since in the words of one fisher, "fishermen are encouraged to fish as much as they can, whilst they can". Both the Line and Trawl Plans allocated quota on the basis of history. In this way, decision-makers were seen as, "the biggest threat to the industry" where, "the way the logbook system worked meant that you were penalised unless you still went out – even if you didn't need too". For these reasons, some fishers made comments such as, "I can't see how the environment is better off for the [e.g.] trawl plan".

b. Interpretation of quantitative results and how interpretation of institutional change can influence social resilience

Quantitative results suggested that a positive interpretation of policy (e.g. the level of equity, the rate of implementation, anticipatory impacts and conservation effectiveness) had a positive effect on social resilience. Qualitative results supported these findings. Fishers that did not feel threatened by the prospect of policy change believed that policy change is implemented as well as possible and these feelings encouraged them to believe that they could cope with policy change and the risks involved. However, policy interpretation was highly correlated with policy involvement, suggesting that the way in which policies are interpreted depends on their involvement in the decision-making process. Figure 9.7 provides a causal mechanism based on the qualitative data to describe how policy interpretation, involvement and implementation can influence social resilience. It suggests that fishers that are involved in the decision-making process are in direct interaction with managers in what is commonly referred

to as, "the battle zone". This interaction makes fishers believe that they have little control over the direction of their future, and thus they negatively assess the risks associated with change. The model presented in figure 8 also suggests that the level of involvement in the decision-making process can influence how policy changes are interpreted. Policies can be interpreted for their anticipated impacts, the appropriateness of the rate of implementation, the level of equity and their effectiveness in meeting conservation needs. Depending on whether policies are interpreted positively or negatively can psychologically influence the proximity to the threshold of coping and the assessment of the risk associated with policy change.

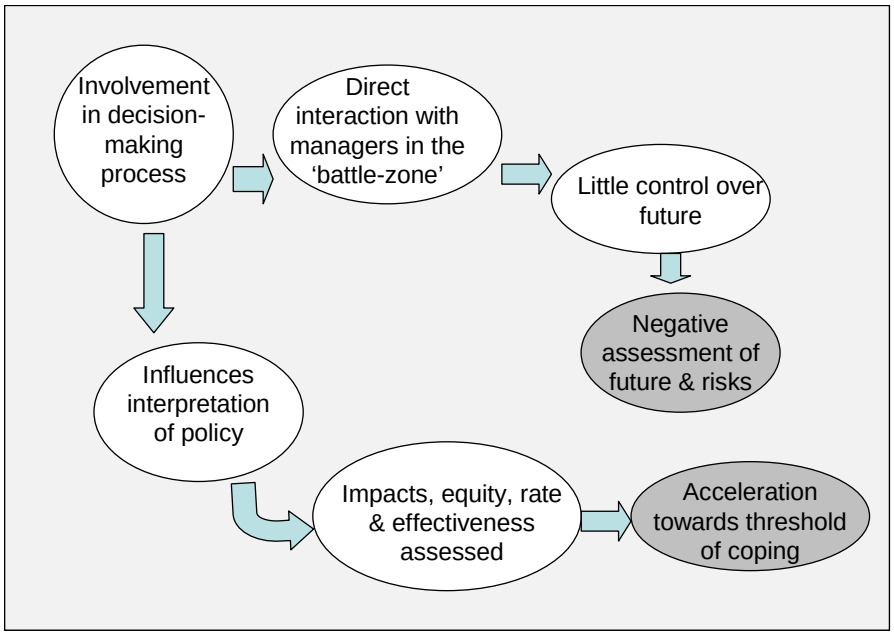


Figure 9.7. A summary of qualitative results: a mechanism describing how the policy involvement and interpretation can significantly affect resilience to change.

9.4 Discussion

Meaningful involvement in the decision-making process is paramount for the positive interpretation of policy change and for a positive response to policy change in terms of the ability to cope and adapt. In this way, policy involvement and interpretation are intrinsically linked and it is the combined effect that has significant influence on social resilience. Fishers that are meaningfully involved in the decision-making process feel understood and respected by fisheries managers and these feelings help fishers to perceive that they can creatively incorporate change into their working-lives. Fishers that perceive that they are meaningfully involved in the decision-making process are more likely to interpret policy change positively;

they are more likely to understand and respect the need for institutional change, are more likely to feel that the outcomes are equitable, are less likely to anticipate negative impacts and not feel as if they are personally being held liable to bear the costs of the change. In contrast, fishers that do not have the opportunity to be meaningfully involved in the process tend to feel that policy changes are 'unfair', 'unnecessary', 'wrong', 'immoral' and 'illegal', where some people do well out of them, and others do poorly. These fishers perceive that they are closer to their threshold of coping.

The comparison between quantity and quality of involvement in the decision-making process has been an important distinction to make. Although many researchers will discuss the importance of involvement (e.g. Beckley 1995), or the meaningful involvement in the decision-making process (e.g. (Charles 1992, Maiolo et al. 1992, Jones 1999), few researchers have emphasised the detrimental consequences of a lack of meaningful involvement. Yet, researchers frequently observe that people affected by new and restrictive policies are rarely, if ever, meaningfully involved in the decision-making process (Beckley 1995, Jentoft and McCay 1995, Hanna 1996, Cochrane 2000). As a consequence, researchers have shown that policies are more controversial, more disruptive and less effective since people will resist them (Rogers 1983, Putnam 1993, Sutinen 1998, Sutinen and Kuperan 1999). In the Torres Strait, for example, the lack of opportunities to participate meaningfully in the development of the international boundary between Australia and Papua New Guinea has placed local indigenous fishers in significant conflict with Treaty administrators (Schug 1996).

This study has shown that meaningful involvement in the decision-making process is essential to foster feelings of satisfaction, understanding, trust and confidence in the future. These feelings are necessary for a successful transition to adapting to policy change. These results progress our understanding of how people respond to change. If people feel confident about their future and the future of the resource, then they are more likely to positively assess the risks associated with policy change and their ability to cope: both of which are as important in maintaining social resilience. Beckley (1995) has shown that a vibrant timber-dependent community in Canada in which a major mill was sold and no longer locally run – where decisions regarding the mill became nationally oriented -quickly disintegrated. Kallstrom and Ljung (2001) describe that, within a farming context, farmers must be satisfied with their situation in terms of control over decisions in order for social sustainability and environmental goals to be achieved. Kallstrom and Ljung (2001) believe that by participating in decisions regarding the future conditions of farming, and by taking part in the public debate, day-to-day

farming becomes more meaningful, social identities are strengthened and enables a stronger sense of 'self-in-place' which is important for the development of self and a personal identity.

9.4.1 An operational model of the influence of policy perception on social resilience

This study represents an attempt to identify the important elements of policy change that can affect the ability of resource-users to be resilient to policy change. The conceptual model developed in chapter four hypothesised that policy change could affect social resilience as a result of the level of involvement in the decision-making process, the perception of equity, the anticipation of impacts and the perception of the rate of implementation. Results from this chapter (figure 9.8) show that these factors are highly correlated (F) and, in combination, are significantly correlated with two of the four dimensions of social resilience identified in chapter 7: the assessment of risk and the proximity to the threshold of coping (E). In order for resource-users to respond positively to policy change, they need to perceive that they have been meaningfully involved in the decision-making process, that the policy has been implemented at a rate to which they can adapt, that the policy is effective in protecting the resource, that equity has been properly addressed and that impacts are positively anticipated.

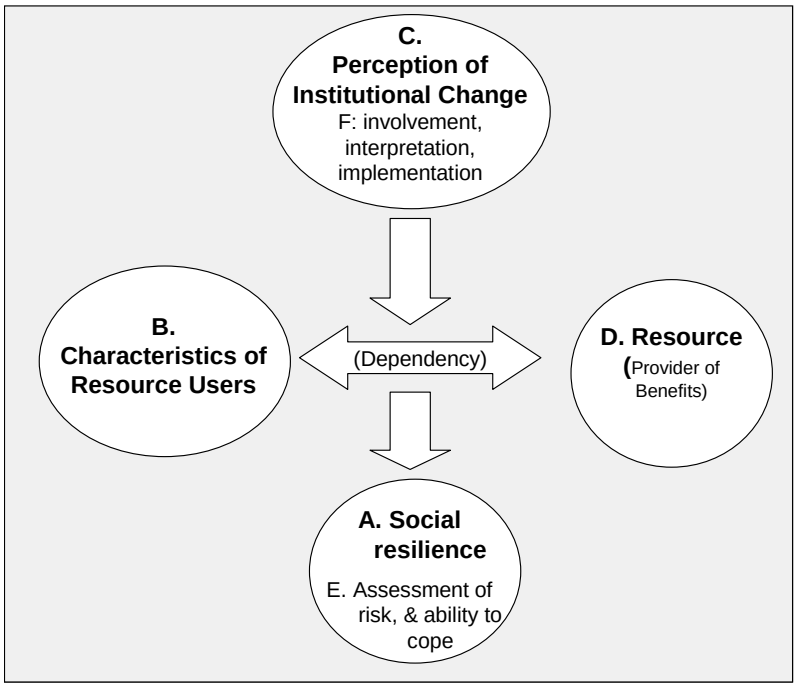


Figure 9.8. An operational model of the influence of policy perception on social resilience

Chapter 10

General Discussion

"We protect what we love, we love what we understand, we understand what we are taught""

Baba Dioum in (Pajak 2000) page 28.

10.1 Introduction

This study examines how a particular social system – the commercial fishing industry in North Queensland - responds and adapts to changes in resource policy. In doing so, it has developed survey scales and tools and shown that the response of commercial fishers has four main components. They represent a fisher's assessment of the level of risk associated with change, the ability to plan and reorganise, the ability to cope, and the level of interest in change (chapter 7). These response components can be influenced by the level of dependency on the resource (chapter 8), and by the perception of the policy-change event itself (chapter 9). These results support the conceptual model of the characteristics and linkages between policy-change, resource-users, the resource and social resilience (chapter 5). However, application of the model to the commercial fishing industry in North Queensland also indicated that whilst resource dependency is an important influence on social resilience, not all aspects of resource dependency are significant. This knowledge provides some insights as to what determines the resilience of socio-ecological systems such as the commercial fishing industry. It suggests that the nature of the relationship with the resource can influence the ability of resource-users to cope and adapt to the requirements of policy change. It also suggests that policy design and implementation have a significant role in maintaining system resilience.

In order to determine the probability that a policy change may erode system resilience, the concept of stability landscapes is applied (chapter 2). This theoretical tool has only recently been broadly applied to the management of resource systems, and only preliminary attempts have been made for social systems (Walker et al. 2004, Hughes et al. 2005). In this chapter I

examine the results of the study in light of emerging theory and illustrate the utility of stability landscapes in interpreting the likely trajectory of the social system. Knowledge developed during the course of this research can be used to further progress the concept of stability landscapes in the context of the commercial fishing industry. In particular, the key components comprising stability landscapes (precariousness, resistance, latitude and thresholds) are identified and described. I then suggest some directions for future research. Finally, I discuss some of the management implications that arise from this work. Although this study pertains specifically to the commercial fishing industry, results can be used to assist natural resource managers deal with the challenge of managing for socio-ecological resilience, generally.

10.2 An operational model of social resilience

An operational model of social resilience for the commercial fishing industry in North Queensland is presented in figure 10.1. The model incorporates the results from this study into the conceptual model developed in chapter five. The operational model highlights the key characteristics and important linkages between the main social components of the fisheries system. The model suggests that institutional change (the change event) and the perception of it can influence the resilience of resource-users (the recipients) depending on the nature of their relationship with the resource. It shows that institutional change can influence resource-users through the quality of involvement in the decision-making process, the anticipation of impacts and the perception of the rate of policy implementation, the level of equity and the perceived effectiveness in meeting conservation goals (chapter 9). Attachment to the occupation, employability, and business size and approach are important resource-dependent characteristics of resource-users that can influence social resilience (chapter 8). Resilience is characterised by the assessment of risk, ability to plan and reorganise, ability to cope and the level of interest in change (chapter 7). The outcome is a function of the sustainability of the social system (figure 10.1) (Altmann et al. 2000, Anderson 2000).

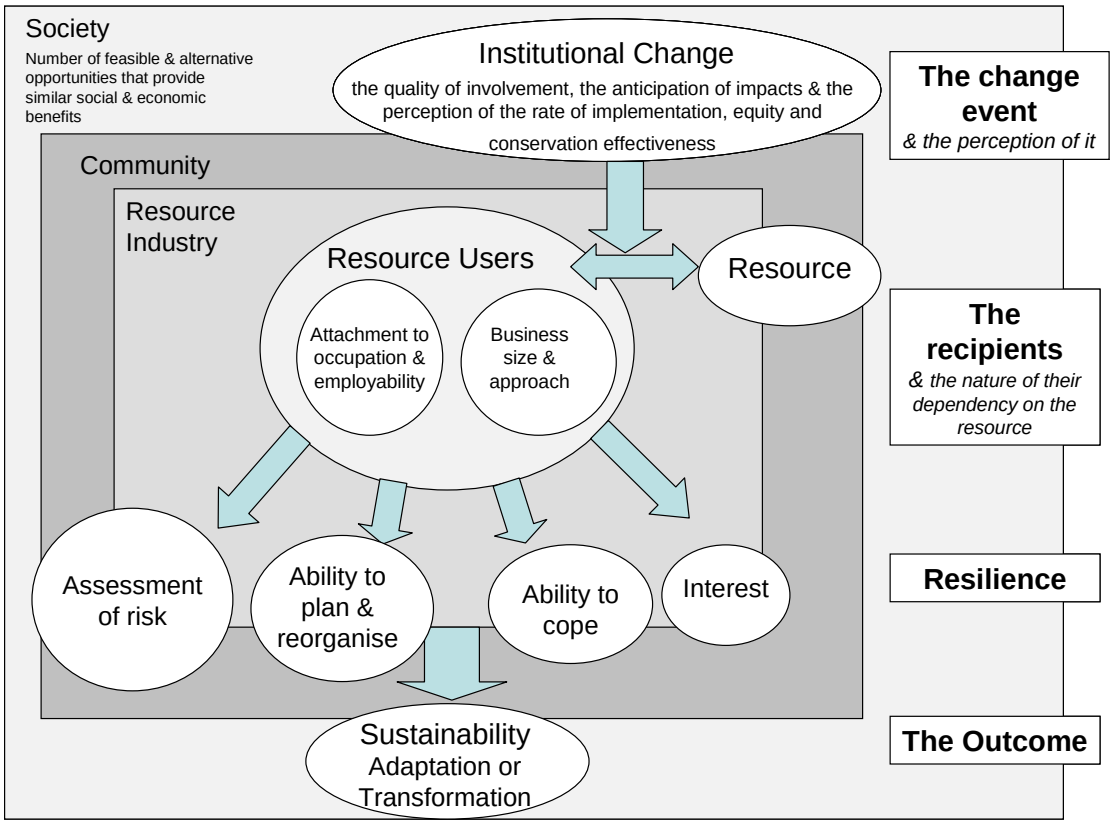


Figure 10.1 An operational model of social resilience to institutional change for the commercial fishing industry in North Queensland

This operational model is useful to describe the linkages between, and key characteristics of, the main social components of the resource system (Anderies et al. 2004). However, the current trajectory of the social system, or the probability that a policy change will erode system resilience, is best described using the concept of stability landscapes (Walker et al. 2004). Stability landscapes were introduced in chapter 2 as a way of describing the state of a system and its likely trajectory. Stability landscapes are visualised as a series of valleys or domains where thresholds separate 'desirable' domains from 'undesirable' domains. Within this concept, resource-users with low resilience are more likely to enter into an 'undesirable' domain or state (Kallstrom and Ljung 2005). The new state may not only be biologically, economically or socially impoverished, but also irreversible (Walker and Meyer 2004). Resilient resource-users may adapt to change by implementing innovative strategies to remain within the industry or they may secure an alternative and 'desirable' livelihood in another industry. Changing in ways that maintains desirable outcomes is known as 'transformation' (Gunderson and Holling 2002, Holling 2004, Olsson et al. 2004, Walker et al. 2004). Whether resource-

users will adapt, transform or collapse depends on the resilience of users and the current trajectory of the social system (Berkes and Jolly 2001, Folke et al. 2002).

The concept of stability landscapes is particularly useful for interpreting the results from this study. It can provide a measure of the speed towards thresholds and direction of change within the stability landscape. This knowledge can be used to assess the probability that a resource-user will cross a threshold and enter into an 'undesirable' domain. The probability that a particular trajectory will shift the system over a threshold is a function of the precariousness, resistance and latitude of the domain (see chapter 2) (Walker et al. 2004, Walker and Meyers 2004). Figure 10.2 shows what the stability landscape might look like for the commercial fishing industry in North Queensland based on the results of this study. It suggests that a system that is disturbed by policy change is likely to move towards its threshold of coping (Roe and Van Eeten 2001). The policy-change event represents the magnitude of potential energy or force driving resource-users towards the threshold. Resource-users with a low precariousness are further from their threshold of coping and have more scope to adapt to the change requirements. Resource-users with low thresholds of coping have higher precariousness and are more likely to be on a trajectory towards an 'undesirable' domain.

The utility of stability landscapes in interpreting the resilience of social systems can be progressed using results from this study. In particular, results can be used to identify the precariousness of resource-users, the nature of the thresholds between desirable and undesirable domains, and provide measures for resistance and latitude. As described in chapter 2, precariousness is a description of the proximity to the threshold of coping (figure 10.2). It describes the current trajectory of the system and the probability that thresholds will be crossed. On the basis of the results obtained in this study, I suggest that this distance is a measure of the resilience of resource-users: it is the probability that a resource-user or system will cross a threshold and enter into an 'undesirable' domain. That is, precariousness can be measured by: (i) the assessment of risk that is associated with change, (ii) the ability to plan, learn and reorganise, (iii) the ability to cope, and (iv) the level of interest in change.

Whether or not a resource-user will enter into another domain depends, to a large extent, on the nature of the thresholds. The boundaries between two 'desirable' domains are a measure of the 'tenability' of conditions within the current domain (Folke et al. 2003a, Cumming and Collier 2005). For example, when the social, economic, or ecological conditions within the current domain become too difficult to adapt to, a system may transform into a fundamentally

new system (e.g. farming as in figure 10.2) (Folke et al. 2002a, b, Keijzers 2002, Olsson et al. 2004, Folke et al. 2005). The boundaries between 'desirable' and 'undesirable' domains are different. They are measures of the ability to cope and if crossed, they indicate that the system has 'collapsed'. Qualitative results from this study suggest that they are described by the level of financial, emotional and marital stress (chapter 8). Resource-users that respond negatively to policy change, on any one of the four response components, may do so because of the level of current or anticipated stress within their lives. For example, qualitative results in this study suggested that fishers that were low income earners perceived that they were close to their threshold of coping and assessed their ability to adapt to policy change as low. This suggests that strategies to remove additional stress from people's lives (i.e. by providing financial or emotional support) could be effective at increasing the distance to the threshold of coping (or decreasing precariousness).

A key finding of this research is that social resilience can be influenced by resource dependency. Resource-users in this study with a low level of dependency are better able to take advantage of other opportunities (Humphrey 1995, Randall and Ironside 1996, Barnes et al. 1999, Sverrisson 2002). They are better able to self-organise (Gunderson 1999), cope more effectively at an emotional level (Smith 1995) and are more interested in change (Chambers 1989). If conditions within the current domain become untenable, resource-users with low resource-dependency have greater options with which to cross into other desirable states (and without crossing their thresholds of coping) (Osberg 1993). For example, some commercial fishers in this study also had other business ventures that they were also involved in such as cattle farms, newsagencies or food outlets (chapter 8). In the event that conditions become untenable within the commercial fishing industry, these fishers could transform from the fisheries domain into another domain (figure 10.2). This information suggests that domain latitude (valley width) is a measure of resource dependency (figure 10.2). Domains with low resource dependency are expected to have large latitude. Domains with high dependency are expected to have small latitude. In this study, many fishers had a strong attachment to the fishing occupation (high resource dependency). The likelihood that these fishers will transform is low. Their trajectory is much more likely to result in an 'undesirable' domain or collapse.

Another major finding from this study is that social resilience can be influenced by the perception of policy change. Commercial fishers with a negative perception of policy change were observed to have lower resilience. They are likely to reach their thresholds of coping

more quickly (Bellamy et al. 1999, Bellamy et al. 2001). This understanding suggests that domain resistance (valley depth) is a measure of policy perception. Resource-users in this study that had a positive perception of policy change are more likely to absorb the costs of change into their working lives and adapt. They have a higher 'resistance' to the negative effects of change. In contrast, resource-users with a negative perception of policy change are more vulnerable and less able to absorb the change requirements. The proposition that policy perception is a descriptor of the resistance of social systems is supported by researchers such as Sekhar (2004) and Suman et al. (2000). These researchers have also shown that a negative perception of resource-policy can influence the behaviour and emotional response of resource-users, which, as observed in this study, is a major influence on social resilience.

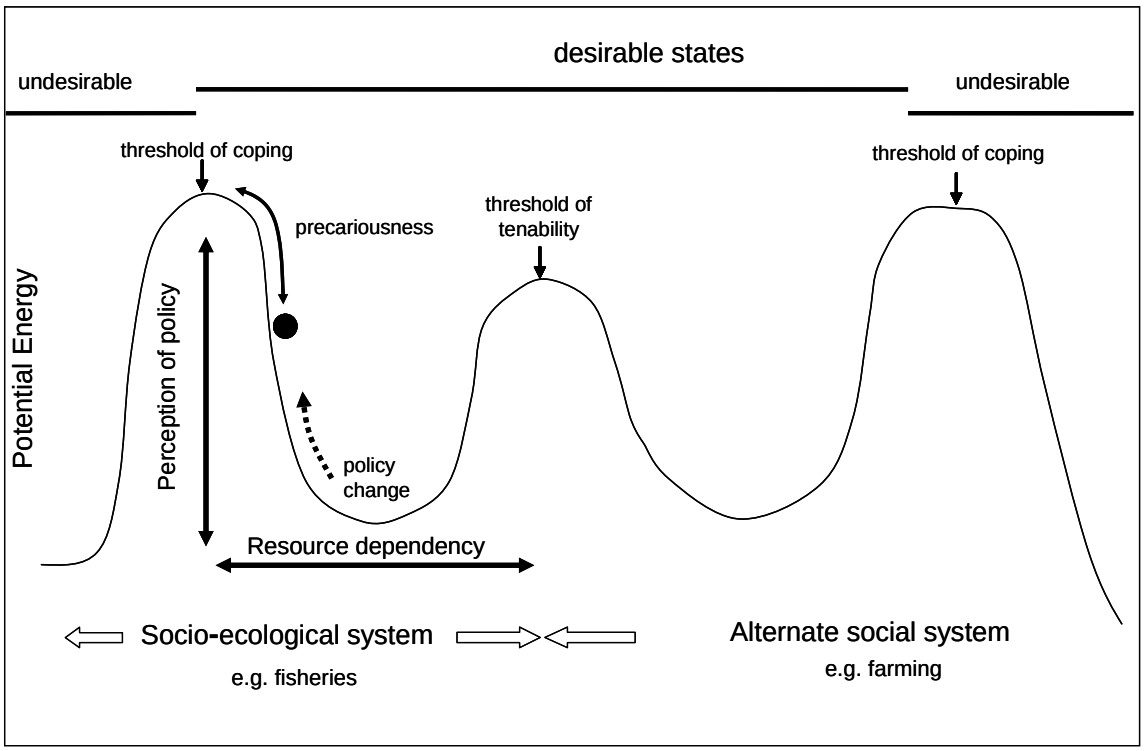


Figure 10.2. A stability landscape model to describe the social resilience of commercial fishers to policy change.

In sum, results from this study have contributed to our ability to recognise some of the conceptual boundaries and variables needed to describe the social components of stability landscapes. These variables are potentially good descriptors of the properties of socio-ecological systems that can erode or enhance social resilience. The identification of these properties can assist in the design of management strategies to enhance social resilience. Prior

to discussing the management implications of this research, however, the implications that arise from this study for future research are discussed.

10.3 Implications for future research

The study of the social components of natural resource management systems is still in its infancy. Gunderson and Holling (2002) observe that the way resource-users respond to periods of change and how society reorganises following change is, "the most neglected and the least understood aspect in conventional resource management and science". Correspondingly, the scope for research contributions within the social sciences is extremely broad. This thesis helps identify some directions for future research to further resolve several important aspects of social resilience. The main directions are those of scale, development of general principles about resource-dependent communities and the identification of other factors that can influence social resilience.

Scale is an important issue in understanding socio-ecological systems (Dumanski et al. 1998, Lovell et al. 2002, Allison et al. 2003, Hughes et al. 2005). This study set out to examine social resilience at the individual level. However, a systemic understanding of social resilience requires knowledge of multiple temporal and spatial scales. Resilience at each level (i.e. individual, industry, community and global scales) has its own set of processes and structures that play out over several scales of space, time and organisation (Begossi 1998). Each set of processes and structures are understood to interact across these multiple scales with complex and varied linkages also existing between the social, ecological and economic components of the system ('panarchies') (Gunderson and Holling 2002, Walker and Meyers 2004). These cross-scale effects are of great significance in the dynamics of socio-ecological systems, where it is generally accepted that it is not possible to understand a system at only one scale (Walker et al. 2004). For the concept of social resilience to become more constructive and functional, further research that aims to understand the linkages between scales and system components is needed (Meffe 2001, Adger et al. 2002, Manfredo and Dayer 2004). Longitudinal research that explores changes in the resilience of different resource-user groups over time would offer important insights in this regards (e.g. Carroll et al. 2000). Results would need to be examined in terms of individual, industry and community responses and correlated with changes in the integrity of the ecological and economic components of each system.

The generalisation of insights to other resource-dependent communities is also important to understand social resilience within a broader context. This thesis has concentrated solely on the commercial fishing industry in North Queensland. The commercial fishing industry is socially and economically important to Australia, and hence there is clear merit in undertaking a thorough examination of the processes and properties that can enhance or erode social resilience within it. Results have highlighted, however, that the industry is unique in several ways. For example, the nature of the attachment to the industry is unusual compared to other resource industries. Specifically, the level of attachment is not dependent upon interaction with others in the occupation (e.g. Poggie and Gersuny 1974, Carroll and Lee 1990). While this thesis concentrates on the resilience of the commercial fishing industry in North Queensland as a case study, it offers a model for use in other resource settings. Future research that tests these ideas on other resource systems is likely to make substantial additional contributions to our understanding of social resilience.

Our understanding of social resilience could also substantially benefit from the identification of other factors that are important influences. This study did not aim to isolate the effect of demographic variables such as 'community', 'age' or 'family' on social resilience. Future studies that focus on these and other demographic variables are likely to provide rich insights into the nature of social resilience. Another fruitful focus for future work within the commercial fishing industry in Queensland would be to isolate any differences in resilience between trawl fishers, line fishers, netters and crabbers. This would potentially provide important information describing the conditions under which social resilience may change.

10.4 Management implications: building socio-ecological resilience

One of the main goals of this study was to provide insights for optimizing both social and environmental outcomes in the management of Queensland's commercial fishing industry. In the introduction to this study it was suggested that with better social knowledge, better resource policies could be designed that not only minimised the social costs associated with resource protection, but also maximised conservation of the environment (Hanna and Smith 1993, Walters 1997, Hampshire et al. 2004, Madden 2004). The premise was that if fishers remain within the industry but are significantly impacted upon by policy change, then they are less able to consider the welfare or integrity of the fisheries resource (Capitani et al. 2004, Hughes et al. 2005, Symes 2005). Fishers with enhanced resilience, however, are more

compliant to new policies and are less likely to cause conflict and delays in implementing resource-protection initiatives (Bengston and Fang 1998, Muth 1998, Bodman et al. 2002, Hampshire et al. 2004). Hence, it is important to have some knowledge of the likely social consequences of resource policies prior to their implementation (Adger 2000, Wiber 2000, Bruckmeier 2005, Bruckmeier and Neuman 2005).

Prior knowledge of the resilience and vulnerabilities of resource-users to institutional change will provide resource managers with the opportunity to assess the likely effects of alternative policy options prior to their implementation (Doody 2003). This strategy can be used to mitigate the negative effects of policy change on resource-users as well as to choose that policy option with minimal social consequences. As a result of this study, resource managers are better equipped with methods to identify the numbers, characteristics and locations of vulnerable resource-users. This information can be collected through standard survey methods based on the scales developed in this study for social resilience, resource dependency and policy perception.

This study also demonstrates that strong social and economic dependency on the resource and the negative perception of policy change can erode social resilience. This information is vitally important for the management of social resilience. These system properties require specific attention if system resilience is to be maintained. For example, resource-users with a strong level of dependency on the resource will require targeted assistance to successfully adapt to changes in government regulations. This might involve assistance in developing skills in planning, learning and reorganising (Folke et al. 2002c, Folke and Gunderson 2002, Gunderson et al. 2002). Managing the perception of policy change may require resource managers to increase the quality of communication with resource-users or providing opportunities and incentives for resource-users to participate in policy design and decision-making processes.

A possible technique to reduce resource dependency and enhance the perception of policy change is 'collaborative learning' (Folke et al. 2005, Payton et al. 2005). Collaboration amongst resource-users provides opportunities for dialogue, sense-making and conflict resolution (Kallstrom and Ljung 2005). Most importantly, it provides the opportunity to increase flexibility through the generation of innovations that encourage resource-users to learn from each other and adapt or transform (Allison and Hobbs 2004, Olstrom et al. 2004, Folke et al. 2005, Gregory et al. 2005). Good leadership is important during this process (Olsson and

Folke 2001, Olsson et al. 2004). Resource-users that learn from collaboration develop confidence in the future, a stronger self-identity and an understanding of the need for resource-protection strategies (Davos 1998, Suman et al. 2000, Schusler et al. 2003). In these ways, collaborative learning enables resource-users to better cope with change and uncertainty.

Industry associations such as the Queensland Seafood Industry Association (QSIA) represent formal collaborations between individual members. However, results from this study suggest that fishing associations may be limited in their ability to increase adaptive capacity of its members through collaborative learning. This is due to the fact that increasing collaboration between commercial fishers may, in fact, be more difficult than increasing collaboration between other resource-users such as farmers (e.g. Kallstrom and Ljung 2005) or loggers (Carroll and Lee 1990). Farmers or loggers, for example, are more likely to collaborate because they form 'occupational communities' where a great deal of time is spent with others from the same occupation in reinforcing each others occupational identities.

If the resilience of commercial fishers is to be enhanced, their ability to learn collaboratively needs to be improved (Feldman et al. 1996). Building capacity through collaborative learning can be facilitated by government organisations charged with managing natural resources (Schusler et al. 2003, Folke et al. 2005). Natural resource management organisations have the ability to provide opportunities and situations in which people can learn and acquire the skills, resource and attitudes to adapt to changes in their environment (Holling 1996, Klein et al. 1998, Vanclay 2003, Davidson-Hunt and Berkes 2004). These bodies can support and facilitate collaborative learning through creating appropriate opportunities, engaging in structured scenarios and employing active adaptive management approaches (Walters 1997, Butler et al. 2001, Folke et al. 2002b, Failing et al. 2004). This may require a more creative approach, however, than has previously been used in Australia. Where resource management organisations have encouraged collaboration between resource-users, social systems have been observed to be better at navigating through transitional periods (Berkes et al. 2003, Davidson-Hunt and Berkes 2004, Olsson et al. 2004, Armitage 2005).

10.5 Conclusion

Managing for resilience is to accept uncertainty and be prepared for change. As summarised by Olsson et al. (2004), "learning how to deal with uncertainty and adapt to changing conditions is becoming essential in a world where humanity plays a major role in shaping

biospheric processes from genetic levels to global scales". To navigate through transitions, resource-users require strong collaborative networks and good leadership. Flexibility and an ability to improvise and switch strategies to meet changing conditions and maintain momentum are also essential in undergoing change. These qualities are likely to be particularly important for the resilience of the commercial fishing industry in North Queensland. This study has developed methods to measure these qualities, thus giving resource managers the ability to assess social resilience prior to the implementation of conservation initiatives. With this knowledge, resource managers have additional tools that bring closer to reality the most fundamental of all human goals: to live in harmony with the environment.

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Reference List

Abel, N. 1998. Complex Adaptive Systems, Evolutionism, and Ecology within Anthropology: Interdisciplinary Research for Understanding Cultural and Ecological Dynamics. Georgia Journal of Ecological Anthropology **2**:6-29.

Abel, N., and A. Langston. 2001. Evolution of a Social-Ecological System: Adaptation and Resilience in the New South Wales Rangelands 1850-2020. CSIRO draft publication. Online at: http://www.cse.csiro.au/research/aglands/nswrangelands/pubs/popular_articles/Draft_Paper.pdf.

Adams, C. 2000. Since the Net Ban: Changes in Commercial Fishing in Florida. Florida Sea Grant College Program Fact Sheet SOEF117: Online at: http://www.southeasternfish.org/Documents/since%20the%20net%20ban.pdf.

Adger, W. N. 2000. Social and Ecological Resilience: Are They Related? Progress in Human Geography **24**:347-364.

Adger, W. N., P. M. Kelly, A. Winkels, L. Q. Huy, and C. Locke. 2002. Migration, Remittances, Livelihood Trajectories, and Social Resilience. Ambio **31**:358-366.

Albrecht, S. L., and J. G. Thompson. 1988. The Place of Attitudes and Perceptions in Social Impact Assessment. Society and Natural Resources **1**:69-80.

Allison, E. H., and F. Ellis. 2001. The Livelihoods Approach and Management of Small-Scale Fisheries. Marine Policy **25**:377-388.

Allison, E. H., and R. J. Hobbs. 2004. Resilience, Adaptive Capacity, and the "Lock-in Trap" of the Western Australian Agricultural Region. Ecology and Society **9**: Online at www.ecoogyandsociety.org/vol9/iss1/art8.

Allison, G. W., S. D. Gaines, J. Lubchenko, and H. P. Possingham. 2003. Ensuring Persistence of Marine Reserves: Catastrophes Require Adopting an Insurance Factor. Ecological Applications **13**:s8-s24.

Al-Naser, F., and M. Sandman. 2000. Evaluating Resilience Factors in the Face of Traumatic Events in Kuwait. Medical Sciences **2**:111-116.

Altman, D. G., V. Rosenquist, J. S. McBride, B. Bailey, and D. Austin. 2000. Churches, Tobacco Farmers, and Community Sustainability: Insights from the Tobacco South. Journal of Community Psychology **28**:151-168.

Anderies, J., M. Janssen, and B. Walker. 2002. Grazing Management, Resilience, and the Dynamics of a Fire-Driven Rangeland System. Ecosystems **5**:23-44.

Anderies, J. M., M. A. Janssen, and E. Ostrom. 2004. A Framework to Analyze the Robustness of Socio-ecological Systems from an Institutional Perspective. Ecology and Society **9**: Online at: www.ecologyandsociety.org/vol9/iss1/art18.

Anderson, B. B. 2000. Composing the Sustainability Message. Agri Marketing **38**:54.

Andrews, W. H. 1996. Social Inventions for Environmental Solutions and Filling Institutional Blanks. Society and Natural Resources **10**:501-505.

Anon. 2005. Holistic Approaches to Fisheries Management Planning and Stakeholder Participation: The Case of the Shetland Islands. World Bank Policy Brief 6. Online at: http://www.sifar.org/DfID_Keysheets/WBPolicyBrief06_1.htm. World Bank.

Agrawal, A. 2002. Common Resources and Insitutitonal Sustainability. In Ostrom, E., Dietz, T., Dolsak, N., Stern, P.C., Stonich, S. and Weber, E.U. (eds) *in* The Drama of the Commons. National Academy Press: Washington DC, pp. 42-85

Armitage, D. 2005. Adaptive Capacity, Social Capital and Co-Management. Online at: http://www.omrn.ca/documents/Armitage.pdf *in* Adaptive Co-Management Symposium. draft paper, Waterloo, Ontario.

Arnstein, S. R. 1969. A Ladder of Citizen Participation. Journal of the American Planning Association, **35**:216-224.

Arrow, K., B. Bolin, R. Costanza, P. Dasgupta, C. Folke, S. M. Holland, A. Jannson, S. Levin, K. Maler, C. Perrings, and D. Pimentel. 1995. Economic Growth, Carrying Capacity, and the Environment. Science **268**:520-521.

Ayensu, E., R. van R. Claasen, M. Collins, A. Bearing, L. Fresco, M. Gadgil, H. Gitay, G. Gisbert, C. Juma, J. Krebs, R. Lepton, J. Lubchenko, J. A. McNeely, H. A. Mooney, P. Pinstrup-Anderson, M. Ramos, P. Raven, W. V. Reid, C. Samper, J. Sarukhan, P. Schei, J. G. Tundisi, R. T. Watson, X. Guanhua, and A. H. Zakri. 1999. International Ecosystem Assessment. Science **286**:658-686.

Bailey, C. 1997. Lessons From Indonesia's 1980 Trawler Ban. Marine Policy **21**:225-235.

Bailey, C., and C. Pomeroy. 1996. Resource Dependency and Development Options in Coastal Southeast Asia. Society and Natural Resources **9**:191-199.

Baland, J., and Platteau, J.P. 1996. Halting Degradation of Natural Resources: Is There a Role for Rural Communities? Clarendon, Oxford

Baland, J., and Platteau, J.P. 1999. The Ambiguous Impact of Inequality on Local Resource Management. World Development **27**: 773-788

Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and R. K. Turner. 2002. Economic Reasons for Conserving Wild Nature. Ecology **297**:950-953.

Barnes, T. J., R. Hayter, and E. Hay. 1999. "Too Young to Retire, Too Bloody Old to Work": Forest Industry Restructuring and Community Response in Port Alberni, British Columbia. The Forestry Chronicle **75**:781-787.

Barry, D., and M. Oelschlaeger. 1996. A Science for Survival: Values and Conservation Biology. Conservation Biology **10**:905-911.

Bass, R. 1998. Evaluating Environmental Justice Under the National Environmental Policy Act. Environmental Impact Assessment Review **18**:83-92.

Batisse, M. 2000. The Challenges of Shared and Sustainable Development. Foresight **2**:461-469.

Becker, H. A. 1988. Social Impact Assessment by Scenario Projects Combining Quantitative and Qualitative Analysis. Impact Assessment Bulletin **6**:84-92.

Becker, H. S., and J. W. Carper. 1956. Elements of Identification with an Occupation. American Sociological Review **21**:341-348.

Beckley, T. M. 1995. Community Stability and the Relationship Between Economic and Social Well-Being in Forest-Dependent Communities. Society and Natural Resources **8**:261-266.

Beckley, T. M. 1998. The Nestedness of Forest Dependence: A Conceptual Framework and Empririical Exploration. Society and Natural Resources **11**:101-120.

Beckley, T. M., and W. Reimer. 1999. Helping Communities Help Themselves: Industry-Community Relations for Sustainable Timber-Dependent Communities. The Forestry Chronicle **75**:805-810.

Begossi, A. 1998. Property Rights for Fisheries at Different Scales - Applications for Conservation in Brazil. Fisheries Research **34**:269-278.

Bellamy, J. A., G. T. McDonald, G. J. Syme, and J. E. Butterworth. 1999. Policy Review Evaluating Integrated Resource Management. Society and Natural Resources **12**:337-353.

Bellamy, J. A., D. H. Walker, G. T. McDonald, and G. J. Syme. 2001. A Systems Approach to the Evaluation of Natural Resource Management Initiatives. Journal of Environmental Management **63**:407-423.

Belsky, J. M. 2002. Beyond the Natural Resource and Environmental Sociology Divide: Insights from a Transdisciplinary Perspective. Society and Natural Resources **15**:269-280.

Bene, C., and A. Tewfik. 2002. Fishing Effort Allocation and Fishermen's Decision Making Process in a Multi-Species Small-Scale Fishery: Analysis of the Conch and Lobster Fishery in Turks and Caicos Islands. Human Ecology **59**:157-186.

Bengston, D. N., and D. P. Fan. 1998. Conflict over Natural Resource Management: A Social Indicator Based on Analysis of Online News Media Text. Society and Natural Resources **12**:493-500.

Bennett, K. 2001. Voicing Power: Women, Family Farming and Patriarchal Webs. Centre for Rural Economy Working Paper Series Working Paper 62: February 2001.

Bennett, K., T. Carroll, P. Lowe, and J. Phillipson. 2002. Coping with Crisis in Cumbria: The Consequences of Foot and Mouth Disease. Online at: http://www.ncl.ac.uk/cre/publications/research_reports/rr02_01Cumbria.htm. University of Newcastle: Centre for Rural Economy Research Report, Newcastle upon Tyne.

Berkes, F. 1985. Fishermen and 'The Tragedy of the Commons'. Environmental Conservation **12**:199-206.

Berkes, F., J. Colding, and C. Folke. 2003. Introduction. Pages 1-29 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Berkes, F., and C. Folke. 1998. Linking Social and Ecological Systems for Resilience and Sustainability. Pages 1-25 *in* F. Berkes and C. Folke, editors. Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience. Cambridge University Press, Cambridge.

Berkes, F., and D. Jolly. 2001. Adapting to Climate Change: Social-Ecological Resilience in a Canadian Western Artic Community. Conservation Ecology **5**: Online at: www.consecol.org/vol5/iss2/art18.

Biscoe, N. 2002. A Closer Look at Resilience: Rebounding from the Pain of the Past. Online at: www.region7.ou.edu/papers/resiliency.

Bliss, J. C., T. L. Walkingstick, and C. Bailey. 1998. Development or Dependency? Journal of Forestry **96**:24-30.

Bodman, P. M., H. F. Campbell, and R. B. Skinner. 2002. The One That Got Away? Crime and Punishment in Queensland's Commercial Fisheries. Pages 320-328 in Australian Economic Papers. Blackwell Publishing Ltd/ University of Adelaide and Flinders University of South Australia.

Bonzon, A. 2000. Development of Economic and Social Indicators for the Management of Mediterranean Fisheries. Marine and Freshwater Research **51**:493-500.

Boserup, E. 1981. Population and Technological Change: A Study of Long-term Trends. University of Chicago Press, Chicago.

Bowler, S., and T. Donovan. 2002. Democracy, Institutions and Attitudes about Citizen Influence in Government. British Journal of Political Science **32**:371-391.

Brabant, S., and R. Gramling. 1997. Resource Extraction and Fluctuations in Poverty: A Case Study. Society and Natural Resources **10**:97-106.

Bradley, D., and A. Grainger. 2004. Social Resilience as a Controlling Influence on Desertification in Senegal. Land Degradation and Development **15**:451-470.

Bryant, R. L., and G. A. Wilson. 1998. Rethinking Environmental Management. Progress in Human Geography **22**:321-343.

Brody, S. D. 2003. Examining the Role of Resource-Based Industries in Ecosystem Approaches to Management: An Evaluation of Comprehensive Plans in Florida. Society and Natural Resources **16**:625-641.

Brooks, N., and W. N. Adger. 2004. Assessing and Enhancing Adaptive Capacity. Pages 165-181 *in* B. Lim and E. Spanger-Siegfried, editors. Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures. Cambridge University Press, Cambridge.

Brooks, N., W. N. Adger, and P. M. Kelly. 2005. The Determinants of Vulnerability and Adaptive Capacity at the National Level and the Implications for Adaptation. Global Environmental Change *in press*.

Brookshire, D. S., and R. C. D'Arge. 1980. Adjustment Issues of Impacted Communities Or, Are Boomtowns Bad? Natural Resources Journal **20**:523-546.

Broome, G., and P. Valentine. 1995. Principles of Social Impact Assessment and its Application to Managing the Great Barrier Reef. Technical Report No. 2, CRC Reef Research Centre, Townsville.

Bruckmeier, K. 2005. Interdisciplinary Conflict Analysis and Conflict Mitigation in Local Resource Management. Ambio **34**:65-73.

Bruckmeier, K., and E. Neuman. 2005. Local Fisheries Management at the Swedish Coast: Biological and Social Preconditions. Ambio **34**:91-100.

Brunckhorst, D. J. 2002. Institutions to Sustain Ecological and Social Systems. Ecological Management and Restoration **3**:108-116.

Buchy, M., and D. Race. 2001. The Twists and Turns of Community Participation in Natural Resource Management. Journal of Environmental Planning and Management **44**:293-308.

Burdge, R. J. 1987. The Social Impact Assessment Model and the Planning Process. Environmental Impact Assessment Review **7**:141-150.

Burdge, R. J., and R. A. Robertson. 1990. Social Impact Assessment and the Public Involvement Process. Environmental Impact Assessment Review **10**:81-90.

Burdge, R. J., and F. Vanclay. 1996. Social Impact Assessment: A Contribution to the State of the Art Series. Impact Assessment Bulletin 14th March 1996.

Buttel, F. H. 1987. New Directions in Environmental Sociology. Annual Review of Sociology **13**:465-488.

Butler, M. J., L. L. Steele, and R. A. Robertson. 2001. Adaptive Resource Management in the New England Groundfish Fishery: Implications for Public Participation and Impact Assessment. Society and Natural Resources **14**:791-801.

Caddy, J. F. 1999. Fisheries Management in the Twenty-First Century: Will New Paradigms Apply? Reviews in Fish Biology and Fisheries **9**:1-43.

Campbell, K. E. 1997. Sociologists' Contributions to the Study of Social Change and Social Inequality. Social Science Research **26**:229-234.

Canan, P., and M. Hennessey. 1983. Community Values as the Context for Interpreting Social Impacts. Environmental Impact Assessment Review **3/4**:351-365.

Capitani, C., B. Tissot, M. S. Carroll, W. Walsh, and S. Peck. 2004. Competing Perspectives in Resource Protection: The Case of Marine Protected Areas in West Hawaii. Society and Natural Resources **17**:763-778.

Carmines, E. G., and R. A. Zeller. 1979. Reliability and Validity Assessment. Sage Publications, Beverly Hills.

Carpenter, S., and W. A. Brock. 2004. Spatial Complexity, Resilience, and Policy Diversity: Fishing on Lake-rich Landscapes. Ecology and Society **9**: Online at www.ecoogyandsociety.org/vol9/iss1/art8.

Carpenter, S., and L. Gunderson. 2001. Coping with Collapse: Ecological and Social Dynamics in Ecosystem Management. Bioscience **51**:451-457.

Carpenter, S., B. Walker, J. Anderies, and N. Abel. 2001. From Metaphor to Measurement: Resilience of What to What? Ecosystems **4**:765-781.

Carroll, M. S., and R. G. Lee. 1990. Occupational Community and Identity Among Pacific NorthWestern Loggers: Implications for Adapting to Economic Changes. Pages 141-154 *in* R. G. Lee, D. R. Field, and W. R. J. Burch, editors. Community and Forestry: Continuities in the Sociology of Natural Resources. Westview Press, Colorado.

Carroll, M. S., K. A. Blatner, F. J. Alt, E. G. Schuster, and A. J. Findley. 2000. Adaptation Strategies of Displaced Idaho Woods Workers: Results of a Longitudinal Panel Study. Society and Natural Resources **13**:95-113.

Cernea, M. M. 1993. The Sociologist's Approach to Sustainable Development. Finance and Development **30**:1-7.

Chambers, R. 1989. Editorial Introduction: Vulnerability, Coping and Policy. Institute of Development Studies Bulletin **20**:1-7.

Charles, A. T. 1992. Fishery Conflicts. A Unified Framework. Marine Policy **16**:379-393.

Chen, P. Y., and P. M. Popovich. 2002. Correlation: Parametric and Nonparametric Measures. Sage, CA.

Chong, K. 2000. Using Sustainability Indicators to Manage Fisheries: Experiences on the Bay of Bengal. Marine and Freshwater Research **51**:523-527.

Cinner, J. 2005. Socioeconomic Factors Influencing Customary Marine Tenure in the Indo-Pacific. Ecology and Society **10**: Online at: www.ecologyandsociety.org/vol10/iss11/art36.

Clark, W. C. 1990. Learning From the Past: Traditional Knowledge and Sustainable Development. The Contemporary Pacific **2**:233-253.

Clay, P. M., and J. R. McGoodwin. 1995. Utilizing Social Sciences in Fisheries Management. Aquatic Living Resources **8**:203-207.

Coakes, S. 1998. Valuing the Social Dimension: Social Impact Assessment in the Regional Forest Agreement Process. Australian Journal of Environmental Management **5**:47-54.

Cochrane, K. L. 2000. Reconciling Sustainability, Economic Efficiency and Equity in Fisheries: The One That Got Away. Fish and Fisheries **1**:3-21.

Coghlan, A. 2002. Cod Fishing Ban Needed in Europe. New Scientist **24** October 2002: Online at: www.newscientist.com.

Colding, J., T. Elmqvist, and P. Olsson. 2003. Living with Disturbance: Building Resilience in Social-Ecolgoical Systems. Pages 163-185 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Coleman, J. S. 1988. Social Capital in the Creation of Human Capital. American Journal of Sociology **94**:s95-s120.

Connor, R. D., and S. R. Dovers. 2002. Institutional Change and Learning for Sustainable Development. Edward Edgar, Melbourne.

Cook, A. K. 1995. Increasing Poverty in Timber-Dependent Areas in Western Washington. Society and Natural Resources **8**:97-109.

Costanza, R., H. Daly, C. Folke, P. Hawken, C. S. Holling, A. McMichael, D. Pimentel, and D. J. Rapport. 2000. Managing Our Environmental Portfolio. Bioscience **50**:149-155.

Craig, D. 1990. Social Impact Assessment: Politically Oriented Approaches and Applications. Environmental Impact Assessment Review **10**:37-54.

Crean, K. 1999. Centralised and Community-Based Fisheries Management Strategies: Case Studies from Two Fisheries Dependent Archipelagos. Marine Policy **23**:243-357.

Cumming, G. S., and J. Collier. 2005. Change and Identity in Complex Systems. Ecology and Society **10**: Online at: www.ecologyandsociety.org/vol10/iss11/art29/.

Curtis, A., A. Britton, and J. Sobels. 1999. Landcare Networks in Australia: State-sponsored Participation Through Local Organisations. Journal of Environmental Planning and Management **42**:5-21.

Curtis, A., and T. De Lacy. 1996. Landcare in Australia: Does it Make a Difference? Journal of Environmental Management **46**:119-137.

Curtis, A., and M. Van Nouhuys. 1999. Landcare Participation in Australia: The Volunteer Perspective. Sustainable Development **7**:98-111.

Curtis, A., M. Van Nouhuys, W. Robinson, and J. Mackay. 2000. Exploring Landcare Effectiveness Using Organisational Theory. Australian Geographer **31**:349-366.

Daily, G. C., T. Soderqvist, S. Aniyar, K. Arrow, P. Dasgupta, P. R. Ehrich, C. Folke, A. Jansson, B. Jansson, N. Kautsky, S. Levin, J. Lubchenko, K. Maler, D. Simpson, D. Starrett, D. Tilman, and B. Walker. 2000. The Value of Nature and the Nature of Value. Science **289**:395.

Dasgupta, P., and K. Maler. 2001. Wealth as a Criterion for Sustainable Development. Pages Online at: http://www.beijer.kva.se/publications/pdf-archive/Disc139.pdf *in*. Beijer International Institute of Ecological Economics, Stokholm.

Davidson-Hunt, I. J., and F. Berkes. 2004. Nature and Society Through the Lens of Resilience: Toward a Human-in-Ecosystem Perspective. Pages 53-81 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Davis, A., and C. Bailey. 1996. Common in Custom, Uncommon in Advantage: Common Property, Local Elites, and Alternative Approaches to Fisheries Management. Society and Natural Resources **9**:251-265.

Davos, C. A. 1998. Sustaining Co-operation for Coastal Sustainability. Journal of Environmental Management **52**:379-387.

Dayton, P. K. 2003. The Importance of the Natural Sciences to Conservation. The American Naturalist **162**:1-13.

Dolsak, N. and Ostrom, E. 2003. The Challenge of the Commons. *In* Dolsak, N. and Ostrom, E. (eds) The Commons in the New Millennium. MIT Press: Cambridge, pp. 3-34.

Doody, J. P. 2003. Information Required for Integrated Coastal Zone Management: Conclusions from the European Demonstration Programme. Coastal Management **31**:163-173.

Duane, T. P. 1997. Community Participation in Ecosystem Management. Ecology Law Quarterly **4**:771-797.

Dumanski, J., W. W. Pettapiece, and R. J. McGregor. 1998. Relevance of Scale Dependent Approaches for Integrating Biophysical and Socio-economic Information and Development of Agroecological Indicators. Nutrient Cycling in Agroecosystems **50**:13-22.

Ehrich, P. R. 1994. Ecological Economics and the Carrying Capacity of Earth. Pages 39-56 *in* A. Jansson, M. Hammer, C. Folke, and R. Costanza, editors. Investing in Natural Capital. Island Press, Washington DC.

Feldman, M. W., K. Aoki, and J. Kumm. 1996. Individual Versus Social Learning. Anthropological Science **104**:209-232.

Failing, L., G. Horn, and P. Higgins. 2004. Using Expert Judgement and Stakeholder Values to Evaluate Adaptive Management Options. Ecology and Society **9**:Online at: www.ecologyandsociety.org/vol9/iss1/art13.

Farmer, F. L., and S. L. Albrecht. 1998. The Biophysical Environment and Human Health: Toward Understanding the Reciprocal Effects. Society and Natural Resources **11**:707-717.

Fenton, D. M. 2004. Framework Development: Indicators of Capacity, Performance and Change in Regional NRM Bodies. Socio-economic Indicators for NRM: Project 1.1. Land and Water Resources Research and Development Corporation, Canberra.

Fenton, D. M., and N. Marshall. 2001a. A Guide to the Fishers of Queensland. Part C. TRC-Analysis and Social Profiles of Queensland's Charter Fishing Industry. Technical Report No. 38, CRC Reef Research Centre.

Fenton, D. M., and N. A. Marshall. 2001b. A Guide to the Fishers of Queensland. Part A. TRC-Analysis and Social Profiles of Queensland's Commercial Fishing Industry. Technical Report No. 36, CRC Reef Research Centre.

Fenton, D. M., and N. A. Marshall. 2001c. A Guide to the Fishers of Queensland. Part B. TRC-Analysis and Social Profiles of Queensland's Harvest Industry. Technical Report No. 37, CRC Reef Research Centre.

Fenton, M., and G. Carr. 2001. Social Change and Agricultural Extension: A Conceptual Framework and Research Methodology. Report prepared for The Department of Natural Resources and Environment, Victoria.

Field, D. R., and W. R. J. Burch. 1988. Rural Sociology and the Environment. Greenwood Press, Connecticut.

Fisher, D. R. 2001. Resource Dependency and Rural Poverty: Rural Areas in the United States and Japan. Rural Sociology **66**:181-202.

Flora, C. B., and J. L. Flora. 1993. Entrepreneurial Social Infrastructure: A Necessary Ingredient. The Annals of the American Academy of Political and Social Science **529**:48-58.

Flora, J. L. 1998. Social Capital and Communities of Place. Rural Sociology **63**:481-506.

Folke, C. 2001. Social-Ecological Resilience and Behavioural Responses. Pages Online at: http://www.beijer.kva.se/publications/pdf-archive/Disc155.pdf *in* Discussion Paper.

Folke, C. 2003. Conservation, Driving Forces, and Institutions. Ecological Applications **6**:370-372.

Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C. S. Holling, and B. Walker. 2002a. Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations. Ambio **31**:437-440.

Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C. S. Holling, B. Walker, D. N. Bengston, F. Berkes, J. Colding, K. Danell, M. Falkenmark, L. Gordon, R. E. Kasperson, N. Kautsky, A. Kinzig, S. Levin, K. Maler, F. Moberg, L. Ohlsson, E. Ohlsson, W. V. Reid, J. Rockstrom, H. Savenije, and U. Svedin. 2002b. Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations. Pages 73pp. Online at: http://www.unisdr.org/eng/risk-reduction/wssd/resilience-sd.pdf *in* Scientific Background Paper on Resilience for the process of The World Summit on Sustainable Development on behalf of The Environmental Advisory Council to the Swedish Government.

Folke, C., and L. Gunderson. 2002. A Kaleidoscope of Change. Conservation Ecology **6**:19.

Folke, C., J. Colding, and F. Berkes. 2003a. Synthesis: Building Resilience and Adaptive Capacity in Social-Ecological Systems. Pages 352-387 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Folke, C., and L. Gunderson. 2003b. An End and a Beginning. Conservation Ecology **7**: Online at www.consecol.org/vol7/iss2/art13.

Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive Governance of Social-Ecological Systems. Annual Review of Environment and Resources ***In press***.

Folke, C., M. Hammer, R. Costanza, and A. Jansson. 1994. Investing in Natural Capital -Why, What, and How? Pages chapter *in* A. Jansson, M. Hammer, C. Folke, and R. Costanza, editors. Investing in Natural Capital. The Ecological Economics Approach to Sustainability. Island Press, Washington D.C.

Force, J. E., G. E. Machlis, C. Zhang, and A. Kearney. 1993. The Relationship Between Timber Production, Local Historical Events, and Community Social Change: A Quantitative Case Study. Forest Science **39**:722-742.

Fortin, M. J., and C. Gagnon. 1999. An Assessment of Social Impacts of National Parks on Communities in Quebec, Canada. Environmental Conservation **26**:200-211.

Freudenberg, W. R. 1992. Addictive Economies: Extractive Industries and Vulnerable Localities in a Changing World Economy. Rural Sociology **57**:305-332.

Freudenberg, W. R., and R. Gramling. 2002. Scientific Expertise and Natural Resource Decisions: Social Science Participation on Interdisciplinary Scientific Committees. Social Science Quarterly **83**:119-136.

Freudenberg, W. R., and K. M. Keating. 1985. Applying Sociology to Policy: Social Science and the Environmental Impact Statement. Rural Sociology **50**:578-605.

Fricke, P. 1985. Use of Sociological Data in the Allocation of Common Property Resources. Marine Policy **9**:39-52.

Frickel, S., and W. R. Freudenberg. 1996. Mining the Past - Historical Context and the Changing Implications of Natural Resource Extraction. Social Problems **43**:444-466.

Fried, M. 2000. Continuities and Discontinuities of Place. Journal of Environmental Psychology **20**:193-205.

Gadgil, M., P. Olsson, F. Berkes, and C. Folke. 2004. Exploring the Role of Local Ecological Knowledge in Ecosystem Management: Three Case Studies. Pages 189-209 in F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Gerstl, J. E. 1961. Determinants of Occupational Community in High Status Occupations. Sociology Quarterly **6**:37-48.

Gramling, R., and W. R. Freudenberg. 1992. Opportunity-Threat, Development, and Adaptation: Toward a Comprehensive Framework for Social Impact Assessment. Rural Sociology **57**:216-234.

Green, R. 1999. Meaning and Form in Community Perception of Town Character. Journal of Environmental Psychology **19**:311-329.

Gregory, R., T. McDaniels, and D. Fields. 2005. Decision Aiding, Not Dispute Resolution: Creating Insights Through Structured Environmental Decisions. Journal of Policy Analysis and Management **20**:415-432.

Greider, T., and R. S. Krannich. 1985. Perceptions of Problems in Rapid Growth and Stable Communities: A Comparative Analysis. Journal of the Community Development Society **16**:80-96.

Greider, T., and R. L. Little. 1988. Social Action and Social Impacts: Subjective Interpretation of Environmental Change. Society and Natural Resources **1**:45-55.

Gunderson, L. 1999. Resilience, Flexibility and Adaptive Management - Antidotes for Spurious Certitude? Conservation Ecology **3**: Online.

Gunderson, L. 2000. Ecological Resilience - In Theory and Application. Annual Review of Ecological Systems **31**:425-439.

Gunderson, L., C. Folke, M. Lee, and C. S. Holling. 2002. In Memory of Mavericks. Conservation Ecology **6**: Online at: www.consecol.org/vol6/iss2/art19.

Gunderson, L., and C. S. Holling. 2002. Panarchy: Understanding Transformations in Human and Natural Systems. Island Press, Washington, D.C.

Haller, T. 2002. The Understanding of Institutions and their Link to Resource Management from New Institutionalism Perspective. Zurich.

Hampshire, K., S. Bell, and G. Wallace. 2004. "Real" Poachers and Predators: Shades of Meaning in Local Understanding of Threats to Fisheries. Society and Natural Resources **17**:305-318.

Hanna, S. 1996. Creating User-Group Vested Interest in Fishery Management Outcomes: A Case Study. *in* R. M. Meyer, C. Zhang, M. L. Windsor, B. J. McCay, L. J. Hushak, and R. M. Muth, editors. Fisheries Resource Utilization and Policy: Proceedings of the World Fisheries Congress. Theme 2. Science Publishers, Lebanon, USA.

Hanna, S., and C. L. Smith. 1993. Resolving Allocation Conflicts in Fishery Management. Society and Natural Resources **6**:55-69.

Hardin, G. 1968. The Tragedy of the Commons. Science **162**:1243-1248.

Harkes, I., and I. Novaczek. 2002. Presence, Performance, and Institutional Resilience of SASI, A Traditional Management Institution in Central Maluku, Indonesia. Ocean and Coastal Management **45**:237-260.

Harms, J., and G. Sylvia. 2001. A Comparison of Conservation Perspectives Between Scientists, Managers, and Industry in the West Coast Groundfish Fishery. Fisheries **26**:6-15.

Harris, C. C., W. J. McLaughlin, and G. Brown. 1998. Rural Communities in the Interior Columbia Basin. How Resilient Are They? Journal of Forestry **96**:11-15.

Haughton, J. 2004. Living with Environmental Change: Social Vulnerability, Adaptation and Resilience in Vietnam. Journal of Comparative Economics **32**:367-369.

Healey, M. C., and T. Hennessey. 1998. The Paradox of Fairness: The Impact of Escalating Complexity on Fishery Management. Marine Policy **22**:109-118.

Heltberg, R. 2001. Determinants and Impact of Local Institutions for Common Resource Management. Environment and Development Economics **6**:183-208.

Helvey, M. 2004. Seeking COnsensus on Designing Marine Protected Areas: Keeping the Fishing Community Engaged. Coastal Management **32**:173-190.

Henderson, H. 1994. Paths to Sustainable Development. The Role of Social Indicators. Futures **26**:125-137.

Hidalgo, M. C., and B. Hernandez. 2001. Place Attachment: Conceptual and Empirical Questions. Journal of Environmental Psychology **21**:273-281.

Hiedanpaa, J. 2005. The Edges of Conflict and Consensus: A Case for Creativity in Regional Forest Policy in Southwest Finland. Ecological Economics *in press*.

Higgins, V., and S. Lockie. 2002. Re-discovering the Social: Neo-liberalism and Hybrid Practices of Governing in Rural Natural Resource Management. Journal of Rural Studies **18**:419-428.

Hodge, T. 1997. Toward Conceptual Framework for Assessing Progress Toward Sustainability. Social Indicators Research **40**:5-98.

Hofferth, S. L., and J. Iceland. 1998. Social Capital in Rural and Urban Communities. Rural Sociology **63**:574-598.

Holling, C. S. 1973. Resilience and Stability of Ecological Systems. Annual Review in Ecology and Systematics **4**:1-23.

Holling, C. S. 1986. The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change. Pages 292-317 *in* C. W. Clark and R. E. Munn, editors. Sustainable Development of the Biosphere. Cambridge University Press, UK: International Institute for Applied Systems Analysis (IIASA), Cambridge.

Holling, C. S. 1996. Surprise for Science, Resilience for Ecosystems, and Incentives for People. Ecological Applications **6**:733-735.

Holling, C. S. 2004a. Foreword: The Backloop to Sustainability. Pages 33-47 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Holling, C. S. 2004b. From Complex Regions to Complex Worlds. Ecology and Society **9**: Online at: www.ecologyandsociety.org/vol9/iss1/art11.

Holling, C. S., F. Berkes, and C. Folke. 1998. Science, Sustainability and Resource Management. Pages 342-362 *in* F. Berkes and C. Folke, editors. Linking OSical and Ecological Systems. Management Practices and Social Mechanisms for Building Resilience. Cambridge University Press, Cambridge.

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

Horton, P. B., and C. L. Hunt. 1984. Sociology. Sixth Edition. McGraw-Hill Book Company, New York.

Howe, S. 2002. Transition to Sustainable Fisheries. Highlighting the Social and Economic Impacts of 'ESD' Based Legislation on the Seafood Industry. *in* For the Australian Fisheries Academy. Commercial Fisherman from Innisfail, North Queensland.

Hughes, E. C. 1958. Men and Their Work. Free Press, Glencoe.

Hughes, T. P., D. R. Bellwood, C. Folke, R. S. Steneck, and J. Wilson. 2005. New Paradigms for Supporting the Resilience of Marine Ecosystems. Trends in Ecology and Evolution **in press**.

Hughey, K. F. D. 2000. User Led Iniatives in Promoting Sustainable Commercial Fisheries Management - Comparing the Divergent Approaches of Australia and New Zealand. Pages 139-146 *in* P. Hale, Petrie, A., Moloney, D., Sattler, P., editor. Management for Sustainable Ecosystems. Centre for Conservation Biology, The University of Queensland, Brisbane.

Humphrey, C. R. 1994. Introduction: Natural Resource-Dependent Communities and Persistent Rural Poverty in the U.S. - Part II. Society and Natural Resources **7**:201-203.

Humphrey, C. R. 1995. Introduction: Natural Resource-Dependent Communities and Persistent Rural Poverty in the U.S. - Part IV. Society and Natural Resources **8**:93-96.

Hundloe, T., D. P. McPhee, and J. S. Toon. 2002. The Economic Impacts of the GBRMPA RAP on the Commercial Seafood Industry. The University of Queensland, Brisbane.

Illo, J. F. I., and J. B. Polo. 1990. Fishers, Traders, Farmers, Wives. The Life Stories of Ten Women in a Fishing Village. Institute of Phillipine Culture, Manila.

Ives, A. R., K. Gross, and J. L. Klug. 1999. Stability and Variability in Competitive Communities. Science **286**:542-544.

Jabareen, Y. 2004. A Knowledge Map for Describing Variegated and Conflict Domains of Sustainable Development. Journal of Environmental Planning and Management **47**:623-642.

Jackson, J. B., M. Kirby, W. H. Berger, K. A. Bjorndal, L. W. Botsford, B. J. Bourque, R. H. Bradbuyr, R. Cooke, J. Erlandson, J. A. Estes, T. P. Hughes, S. Kidwell, C. B. Lange, H. S. Lenihan, J. M. Pandolfi, C. H. Peterson, R. S. Steneck, M. J. Tegner, and R. R. Warner. 2001. Historical Overfishing and the Recent Collapse of Coastal Ecosystems. Science **293**:629-637.

Jacob, S. J., and F. K. Willits. 1994. Objective and Subjective Indicators of Community Evaluation: A Pennsylvania Assessment. Social Indicators Research **32**:161-177.

Jacob, S. J., F. L. Farmer, M. Jepson, and C. Adams. 2001. Landing a Definition of Fishing Dependent Communities. Fisheries **26**:16-22.

Jentoft, S., and B. J. McCay. 1995. User Participation in Fisheries Management. Marine Policy **19**:227-246.

Jentoft, S., B. J. McCay, and D. C. Wilson. 1998. Social Theory and Fisheries Co-Management. Marine Policy **22**:423-436.

Jigginss, J., and N. Powell. 1999. Participatory Land and Social Assessment. *in* H. A. Becker, F. Vanclay, and C. P. Wolf, editors. Conceptual and Methodological Advances in Social Impact Assessment. Macmillan Press.

Johnson, T. G., and J. I. Stallman. 1994. Human Capital Investment in Resource-Dominated Economies. Society and Natural Resources **7**:221-223.

Johnson, D. H. 1999. The Insignificance of Statistical Significance Testing. Journal of Wildlife Management **63**:763-772.

Jones, R. E., and R. E. Dunlap. 1992. The Social Bases of Environmental Concern: Have They Changed Over Time? Rural Sociology **57**:28-47.

Jones, P. J. S. 1999. Marine Nature Reserves in Britain: Past Lessons, Current Status and Future Issues. Marine Policy **23**:375-396.

Kaczynski, V., and S. W. Looney. 2000. Coastal Resources as an Engine of Economic Growth and Reduction of Poverty in West Africa: Policy Considerations. Coastal Management **28**:235-248.

Kates, R. W., W. C. Clark, R. Corell, M. Hall, C. C. Jaeger, I. Lowe, J. J. McCarthy, H. J. Schnellnhuber, B. Bolin, N. M. Dickson, S. Faucheux, G. C. Gallopin, A. Greubler, B. Huntley, J. Jager, N. S. Jodha, R. E. Kasperson, A. Mabogunje, P. Matson, H. A. Mooney, B. Moore III, T. Riordan, and U. Svedin. 2000. 'Sustainability Science' Research and Assessment Systems for Sustainability Program Discussion Paper 2000-33. Environment and Natural Resources Program, Belfer Centre for Science and International Affairs, Harvard University.

Kay, J. J., H. A. Regier, M. Boyle, and G. Francis. 1999. An Ecosystem Approach for Sustainability: Addressing the Challenge of Complexity. Futures **31**:721-722.

Keijzers, G. 2002. The Transition to the Sustainable Enterprise. Journal of Cleaner Production **10**:349-359.

Kim, J., and C. W. Mueller. 1978. Introduction to Factor Analysis. What It Is and How to Do It. Sage Publications, Iowa City.

King, D. 2000. Uses and Limitations of Socioeconomic Indicators of Community Vulnerability to Natural Hazards: Data and Disasters in Northern Australia. Natural Hazards:1-10.

King, D. 2005. Planning for Hazard Resilient Communities. *in* D. Paton and D. Johnston, editors. Disaster Resilience: an integrated approach. Charles C. Thomas, Springfield, Illinois.

King, G. 2003. The Role of Participation in the European Demonstration Projects in ICZM. Coastal Management **31**:137-143.

King, L. A., and V. L. Hood. 1999. Ecosystem Health and Sustainable Communities. Ecosystem Health **5**:49-57.

King, T. F. 1998. How the Archaeologists Stole Culture: A Gap in American Environmental Impact Assessment Practice and How to Fill It. Environmental Impact Assessment Review **18**:117-133.

Knuth, B. A., and L. A. Nielsen. 1989. Social and Institutional Performance Indicators for Wildlife and Fishery Resource Management Systems. Society and Natural Resources **2**:329-344.

Korpi, T. 2001. Good Friends in Bad Times? Social Networks and Job Search Among the Unemployed in Sweden. Acta Sociologica **44**:157-170.

Krannich, R. S., and T. Greider. 1984. Personal Well-Being in Rapid Growth and Stable Community. Rural Sociology **49**:241-552.

Krannich, R. S., and B. Zollinger. 1997. Pursuing Rural Community Development in Resource-Dependent Areas: Obstacles and Opportunities. Research in Community Sociology **7**:201-222.

Lachapelle, P. R., S. F. McCool, and M. E. Patterson. 2003. Barriers to Effective Natural Resource Planning in a "Messy" World. Society and Natural Resources **16**:473-490.

Lane, D. E., and R. L. Stephenson. 1995. Fisheries Management Science: The Framework to Link Biological, Economic and Social Objectives in Fisheries Management. Aquatic Living Resources **8**:215-221.

Lane, D. E., and R. L. Stephenson. 1997. Fisheries Management Science: Integrating the Roles of Science, Economics, Sociology and Politics in Effective Fisheries Management. Pages 177-182 *in* D. A. Hancock, D. C. Smith, A. Grant, and J. P. Beumer, editors. Developing and Sustaining World Fisheries Resources: The State of Science and Management. The 2nd World Fisheries Congress. CSIRO, Collingwood.

Lane, M. B., and G. T. McDonald. 2002. Crisis, Change and Institutions in Forest Management. Journal of Rural Studies **18**:245-256.

Le Tissier, M. D. A., J. M. Hills, J. A. McGregor, and M. Ireland. 2004. A Training Framework for Understanding Conflict in the Coastal Zone. Coastal Management **32**:77-88.

LeBillon, P. 2001. The Political Ecology of War: Natural Resources and Armed Conflicts. Political Geography **20**:561-584.

Levin, S. 1999. Towards a Science of Ecological Management. Conservation Ecology **3**: Online at; www.consecol.org/vol3/iss2/art6.

Levin, S., S. Barrett, S. Aniyar, W. Baumol, C. Bliss, B. Bolin, P. Dasgupta, P. R. Ehrich, C. Folke, I. Gren, C. S. Holling, A. Jansson, B. Jansson, K. Maler, D. Martin, C. Perrings, and E. Sheshinski. 1998. Resilience in Natural and Socioeconomic Systems. Environment and Development Economics **3**:222-235.

Likert, R. 1932. A Technique for the Measurement of Attitude. Archives of Psychology **22**:140

Locke, C., W. N. Adger, and M. Kelly. 2000. Changing Places (Environmental Impact of Migration). Environment **42**:24-39.

Low, B., E. Ostrom, C. Simon, and J. Wilson. 2004. Redundancy and Diversity: Do They Influence Optimal Management? Pages 83-93 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Ludwig, D., R. Hilborn, and C. Walters. 1993. Uncertainty, Resource Exploitation, and Conservation: Lessons from History. Science **260**:17-18.

Ludwig, D., B. Walker, and C. S. Holling. 1997. Sustainability, Stability and Resilience. Conservation Ecology **1**: Online at: www.consecol.org/vol1/iss1/art7.

Mace, P. 1993. Will Private Owners Practice Prudent Resource Management? Fisheries **18**:29-31.

Machlis, G. E., and J. E. Force. 1988. Community Stability and Timber-Dependent Communities. Rural Sociology **53**:220-234.

Machlis, G. E., J. E. Force, and R. G. Balice. 1990. Timber, Minerals, and Social Change: An Exploratory Test of Two Resource-Dependent Communities. Rural Sociology **55**:411-424.

MacKenzie, D. 2003. Last Chance for European Cod. New Scientist 13 June 2003.

Maiolo, J. R., J. Johnson, and D. Griffith. 1992. Applications of Social Science Theory to Fisheries Management: Three Examples. Society and Natural Resources **5**:391-407.

Manfredo, M. J., and A. A. Dayer. 2004. Concepts for Exploring the Social Aspects of Human-Wildlife Conflict in a Global Context. Human Dimensions of Wildlife **9**:317-328.

Manring, N., P. C. West, and P. Bidol. 1990. Social Impact Assessment and Environmental Conflict Management: Potential for Integration and Application. Environmental Impact Assessment Review **10**:253-265.

Margerum, R. D. 1999. Getting Past Yes. From Capital Creation to Action. Journal of American Planning Association **65**:181-192.

Marsh, A., and J. Williamson. 2001. Early School Leavers in Rural Australia: Are They All 'At Risk'? Rural Society **9**:443-454.

Marshall, J. 2001. Connectivity and Restructuring: Identity and Gender Relations in a Fishing Community. Gender, Place and Culture **8**:391-409.

Mascarenhas, M., and R. Scarce. 2004. "The Intention was Good": Legitimacy, Consensus-Based Decison Making, and the Case of Forest Planning in British Columbia, Canada. Society and Natural Resources **17**:17-38.

Mascia, M. B., J. P. Brosius, T. A. Dobson, B. C. Forbes, L. S. Horowitz, M. A. McKean, and N. J. Turner. 2003. Conservation and the Social Sciences. Conservation Biology **17**:649-650.

Mathieu, P., and J. Trottier. 2002. Water Scarcity, Vulnerability, Livelihoods and Security: The Role of Institutions. Discussion Paper: Online at: www.ihdp.uni-bonn.de/.

Mathis, M. L. 1999. An Application of Integrated Assessment Methods to Water resource Issues in the Binational Lower Rio Grande Basin. Policy Studies Review **16**:138-167.

May, P. J. 2004. Compliance Motivations: Affirmative and Negative Bases. Law and Society Review **38**:41-45.

McCay, B. J. 1978. Systems Ecology, People Ecology, and hte Anthropology of Fishing Communities. Human Ecology **6**:397-421.

McCay, B. J. 1981. Optimal Foragers or Political Actors? Ecological Analyses of a New Jersey Fishery. American Ethnologist **11**:356-382.

McCay, B. J. 1996. Participation of Fishers in Fisheries Management. Pages 60-75 *in* R. M. Meyer, C. Zhang, M. L. Windsor, B. J. McCay, L. J. Husgak, and R. M. Muth, editors. Fisheries Resource Utilization and Policy: Proceedings of the World Fisheries Congress, Theme 2. Science Publishers, Inc., Lebanon, USA.

McCay, B. J. 2000. Environmental Anthropology at Sea. Pages 254-271 *in* C. L. Crumley, A. E. van Deventer, and J. J. Fletcher, editors. New Directions in Anthropology and Environment. Altamira Press, Walnut Creek.

McCay, B. J., and S. Jentoft. 1996. From the Bottom Up: Participatory Issues in Fisheries Management. Society and Natural Resources **9**:237-250.

McCubbin, L. 2001. Challenges to the Definition of Resilience. Pages 20 *in* 109th Annual Meeting of the American Psychological Association, San Francisco, CA.

McPhee, D. P., and T. D. Loveday. 2000. The Queensland Fishing Industry and Ecologically Sustainable Development. Pages 132-138 *in* P. Hale, Petrie, A., Moloney, D., Sattler, P., editor. Management for Sustainable Ecosystems. Centre for Conservation Biology, University of Queensland, Brisbane.

Meffe, G. K. 2001. Crisis in a Crisis Discipline. The Journal of the Society for Conservation Biology **15**:303.

Milbrath, L. W. 1995. Psychological, Cultural, and Informational Barriers to Sustainability. Journal of Social Issues **51**:101.

Milich, L. 1999. Resource Mismanagement Versus Sustainable Livelihoods: The Collapse of the Newfoundland Cod Fishery. Society and Natural Resources **12**:625-642.

Millar, J., and A. Curtis. 1999. The Nature and Role of Farmer Knowledge in Temperate Pasture Management in the Murray-Darling Basin. Rural Society **9**:301-312.

Minnegal, M., T. F. King, R. Just, and P. D. Dwyer. 2004. Deep Identity, Shallow Time: Sustaining a Future in Victorian Fishing Communities. The Australian Journal of Anthropology **14**:53-71.

Mitchell, J. C. 1974. Social Networks. Pages 279-297 *in* J. C. Mitchell, editor. Social Networks in Urban Settings. University of Manchester, Manchester.

Morrison, T. H., G. T. McDonald, and M. B. Lane. 2004. Integrating Natural Resource Management for Better Environmental Outcomes. Australian Geographer **35**:243-258.

Muth, R. M. 1998. The Persistence of Poaching in Advanced Industrial Society: Meanings and Motivations - An Introductory Comment. Society and Natural Resources **11**:5-7.

Nadeau, S., B. Shindler, and C. Kakoyannis. 1999. Forest Communities: New Frameworks for Assessing Sustainability. The Forestry Chronicle **75**:747-754.

Nelson, A. L., and C. Pettit. 2004. Effective Community Engagement for Sustainability: Wombat Community Forest Management Case Study. Australian Geographer **35**:301-315.

NIMH. 2001. Vulnerability and Resilience. Online at: www.nimh.nih.gov/publicat/baschap2. National Institute of Mental Health.

Nord, M. 1994. Natural Resources and Persistent Poverty: In Search of the Nexus. Society and Natural Resources **7**:205-220.

North, D. 1990a. Five Propositions about Institutional Change. *in* Economic History Workshop, Stanford University.

North, D. 1990b. Institutions, Institutional Change and Economic Performance. Cambridge University Press, Cambridge.

Norton, B. 1995. Resilience and Options. Ecological Economics **15**:133-136.

Nunnally, J. C. 1978. Psychometric Theory (2nd ed.). McGraw-Hill, New York.

Nystrom, M., C. Folke, and F. Moberg. 2000. Coral Reef Disturbance and Resilience in a Human-Dominated Environment. Trends in Ecology and Evolution **15**:413-417.

Ogburn, W. F. 1972. Fixity and Persistence in Society. Pages 46-72 *in* R. Nisbet, editor. Social Change. Basil Blackwell Publishers, Oxford.

Ogilvy, J. 2005. Abstract: Scenario Planning, Art or Science? World Futures **61**:331-346.

Olsson, P., S. Carpenter, L. Gunderson, P. Ryan, L. Lebel, C. Folke, and C. S. Holling. 2005. Shooting the Rapids - Navigating Transitions to Adaptive Ecosystem Governance. Ecology and Society *in review*.

Olsson, P., C. Folke, and T. Hahn. 2004. Social-Ecological Transformation for Ecosystem Management: the Development of Adaptive Co-management of a Wetland in Southern Sweden. Ecology and Society **9**: Online at; www.ecologyandsociety.org/vol9/iss4/art2.

Olsson, P., and C. Folke. 2001. Local Ecological Knowledge and Institutional Dynamics for Ecosystem Management: A Study of Lack Racken Watershed, Sweden. Ecosystems **4**:85-104.

Osberg, L. 1993. Fishing in Different Pools: Job Search Strategies and Job-Finding Success in Canada in the Early 1980s. Journal of Labor Economics **11**:348-387.

Ostrom, E. 1999. Revisiting the Commons: Local Lessons, Global Challenges. Science **284**:278-282.

Ostrom, E., J. Burger, C. B. Field, R. B. Norgaard, and D. Policansky. 1999. Revisiting the Commons: Local Lessons, Global Challenges. Science **284**:278-282.

Ostry, A. 1999. The Links Between Industrial, Community, and Ecological Sustainability: A Forestry Case Study. Ecosystem Health **5**:193-203.

Overdevest, C., and G. P. Green. 1995. Forest Dependence and Community Well-Being: A Segmented Market Approach. Society and Natural Resources **8**:111-131.

Pajak, P. 2000. Sustainability, Ecosystem Management, and Indicators: Thinking Globally and Acting Locally in the 21st Century. Fisheries **25**:16-30.

Parkins, J. 1999. Enhancing Social Indicators Research in a Forest-Dependent Community. The Forestry Chronicle **75**:771-780.

Parsons, T. 1966. Societies. Evolutionary and Comparative Perspectives. Prentice-Hall, Inc., New Jersey.

Peluso, N. L., C. R. Humphrey, and L. P. Fortmann. 1994. The Rock, The Beach, and the Tidal Pool: People and Poverty in Natural Resource-Dependent Areas. Society and Natural Resources **7**:23-38.

Peterson, G. 2000. Political Ecology and Ecological Resilience. Ecological Economics **35**:323-336.

Pezzoli, K. 1997. Sustainable Development: A Transdisciplinary Overview of the Literature. Journal of Environmental Planning and Management **40**:549-574.

Poggie, J. J., and C. Gersuny. 1974. Fishermen of Galilee. The Human Ecology of a New England Coastal Community. Rhode Island University Marine Bulletin Series Number 17 National Oceanic and Atmospheric Administration, Kingston.

Polachek, T. 2002. Will "Small Core" Fisheries Solve the Fishery Management Dilemma? Marine Policy **26**:369-371.

Pomeroy, C. 1999. Social Considerations for Marine Resource Management: Evidence from Big Creek Ecological Reserve. California Cooperative Oceanic Fisheries Investigations Reports **40**:118-125.

Pomeroy, C., and J. Beck. 1999. An Experiment in Fishery Co-Management: Evidence from Big Creek. Society and Natural Resources **12**:719-739.

Powell, N. 1999. Re-Conceptualising Resilience for Impact Assessment in Conditions of Systemic Uncertainty. Proceedings from the 3rd Nordic EIA/SEA Conference, 22-23 November 1999:163-174.

Proshanksy, H. 1976. Environmental Psychology: People and their Physical Settings, second edition. Holt, Rinehart and Winston, New York.

Putnam, R. D. 1993. The Prosperous Community. Social Capital and Public Life. American Prospect **13**:35-42.

Putra, S. 2002. Integrated Coastal Zone Management in North Sulawesi-Indonesia. PhD Thesis. James Cook University, Townsville.

Race, D., and M. Buchy. 1999. A Role for Community Participation in Australian Forest Management. Rural Society **9**:405-419.

Randall, J. E., and R. G. Ironside. 1996. Communities on the Edge: An Economic Geography of Resource -Dependent Communities in Canada. The Canadian Geographer **40**:17-35.

Rannikko, P. 1999. Combining Social and Ecological Sustainability in the Nordic Forest Periphery. Sociologia Ruralis **39**:394-410.

Rapport, D. J., C. Gaudet, J. R. Karr, J. S. Baron, C. Bohlen, W. Jackson, B. Jones, R. J. Naiman, B. Norton, and M. M. Pollock. 1998. Evaluating Landscape Health: Integrating Societal Goals and Biophysical Process. Journal of Environmental Management **53**:1-15.

Reed, M. G. 1999. "Jobs Talk": Retreating from the Social Sustainability of Forestry Communities. The Forestry Chronicle **75**:755-763.

Rickson, R. E., R. J. Burdge, T. Hundloe, and G. T. McDonald. 1990a. Institutional Constraints to Adoption of Social Impact Assessment as a Decision-Making and Planning Tool. Environmental Impact Assessment Review **10**:233-243.

Rickson, R. E., J. S. Western, and R. J. Burdge. 1990b. Social Impact Assessment: Knowledge and Development. Environmental Impact Assessment Review **10**:1-10.

Rockstrom, J. 2003. Resilience Building and Water Demand for Drought Mitigation. Physics and Chemistry of the Earth **28**:869-877.

Roe, E. 1996. Why Ecosystem Management Can't Work Without Social Science: An Example from the California Northern Spotted Owl Controversy. Environmental Management **20**:667-674.

Roe, E., and M. Van Eeten. 2001. Threshold-Based Resource Management: A Framework for Comprehensive Ecosystem Management. Environmental Management **27**:195-214.

Rogers, E. M. 1983. Diffusion of Innovations (3rd edition). Free Press, New York.

Rosenberg, A. A., M. J. Fogarty, M. P. Sissenwine, J. R. Beddington, and J. G. Shepherd. 1993. Achieving Sustainable Use of Renewable Resources. Science **262**:828-829.

Saegert, S., and G. H. Winkel. 1990. Environmental Psychology. Annual Review of Psychology **41**:441-477.

SAFPS. 1997. Society of American Foresters: Communities and Forests. Society of American Foresters Position Statement.

Salagrama, V. 2003. Traditional Community-based Management Systems (TCBMS) in Two Fishing Villages in East Godavari District, Andhra Pradesh, India.

Salaman, G. 1974. Community and Occupation. Cambridge University Press, Cambridge.

Salz, R. J. 1998. Social Justice and the Florida Net Ban Controversy. Human Dimensions Research Unit, Department of Natural Resources Conservation, Amherst.

Sandler , T., and F. P. Sterbenz. 1990. Harvest Uncertainty and the Tragedy of the Commons. Journal of Environmental Economics and Management **18**:155-168.

Scheffer, M., S. Carpenter, J. A. Foley, C. Folke, and B. Walker. 2001. Catastrophic Shifts in Ecosystems. Nature **413**:591-596.

Schug, D. M. 1996. International Maritime Boundaries and Indigenous People. Marine Policy **20**:209-222.

Schusler, T. M., D. J. Decker, and M. J. Pfeffer. 2003. Social Learning for Collaborative Natural Resource Management. Society and Natural Resources **16**:309-326.

Schweitzer, M. 1982. The Basic Questions Approach to Social Impact Assessment. Environmental Impact Assessment Review **2**:294-299.

Scoones, I. 1999. New Ecology and the Social Sciences: What Prospects for a Fruitful Engagement? Annual Review of Anthropology **28**:479-507.

Seixas, C. S., and F. Berkes. 2004. Dynamics of Social-Ecological Changes in a Lagoon Fishery in Southern Brazil. Pages 271-297 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Sekhar, N. U. 2004. Fisheries in Chilika Lake: How Community Access and Control Impacts their Management. Journal of Environmental Management **73**:257-266.

Shindler, B., and K. A. Cheek. 1999. Integrating Citizens in Adaptive Management: A Propositional Analysis. Conservation Ecology **3**:9-24.

Smith, A. D. 1973. The Concept of Social Change. A Critique of the Functionalist Theory of Social Change. Routledge and Kegan Paul, London.

Smith, S. 1995. Social Implications of Changes in Fisheries Regulations for Commercial Fishing Families. Fisheries **20**:24-26.

Smith, S., S. J. Jacob, M. Jepson, and G. Israel. 2003. After the Florida Net Ban: The Impacts on Commercial Fishing Families. Society and Natural Resources **16**:39-59.

Sneddon, C., L. Harris, R. Dimitrov, and U. Ozesmi. 2002. Contested Waters: Conflict, Scale, and Sustainability in Aquatic Socio-ecological Systems. Society and Natural Resources **15**:663-675.

Sonn, C. C., and A. T. Fisher. 1998. Sense of Community: Community Resilient Responses to Oppression and Change. Journal of Community Psychology **26**:457-472.

Sorenson, R. L., and K. Kaye. 1999. Conflict Management Strategies Used in Successful Family Businesses. Family Business Review **12**:133.

Stedman, R. C. 1999. Sense of Place as an Indicator of Community Sustainability. The Forestry Chronicle **75**:765-770.

Stemler, S. 2001. An Overview of Content Analysis. Practical Assessment, Research & Evaluation **7**: Online at: http://pareOnline.net/getvn.asp?v=7&n=17.

Suman, D., M. P. Shivlani, and J. W. Milon. 2000. Perceptions and Attitudes Regarding Marine Reserves: A Comparison of Stakeholder Groups in the Florida Keys National Marine Sanctuary. Ocean and Coastal Management **42**:1019-1040.

Sutinen, J. G. 1998. Blue Water Crime: Deterrence, Legitimacy, and Compliance in Fisheries. Law and Society Review **32**:309-313.

Sutinen, J. G., and K. Kuperan. 1999. A Socio-Economic Theory of Regulatory Compliance. International Journal of Social Economics **26**:174-193.

Sutton, S. G., and R. B. Ditton. 2001. Understanding Catch-and-Release Behaviour Among U.S. Atlantic Bluefin Tuna Anglers. Human Dimensions of Wildlife **6**:49-66.

Swanson, G. E. 1971. Social Change. Scott, Foresman and Company, Illinois.

Sydnes, A. K. 2001. Regional Fishery Organisations: How and Why Organisational Diversity Matters. Ocean Development and International Law **32**:349-372.

Symes, D. 1996. Fisheries Management and the Social Sciences: A Way Forward? Sociologia Ruralis **36**:146-151.

Symes, D. 2005. Fishing, the Environment and the Media. Fisheries Research **73**:13-19.

Tabachnick, B. G., and L. S. Fidell. 1996. Using Multivariate Statistics, Third Edition. Harper Collins College Publishers, California.

Tindall, D. B., and B. Wellman. 2001. Canada as Social Structure: Social Network Analysis and Canadian Sociology. Canadian Journal of Sociology **26**:265-305.

Torsvik, G. 2000. Social Capital and Economic Development: A Plea for the Mechanisms. Rationality and Society **12**:451-476.

Tracey, J. L. 1995. Coping with Insecurity: Family Firms in the New South Wales Logging Industry. PhD Thesis. The Australian National University, Canberra.

Trosper, R. L. 2003a. Resilience in Pre-Contact Pacific Northwest Social Ecological Systems. Conservation Ecology **7**: Online at: www.consecol.org/vol7/iss3/art6.

Trosper, R. L. 2003b. Policy Transformations in the US Forest Sector, 1970-2000: Implications for Sustainable Use and Resilience. Pages 328-351 *in* F. Berkes, J. Colding, and C. Folke, editors. Navigating Social-Ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge.

Turner, R. K. 2000. Integrating Natural and Socio-Economic Science in Coastal Management. Journal of Marine Science **25**:447-460.

Twigger-Ross, C. L., and D. L. Uzzell. 1996. Place and Identity Processes. Journal of Environmental Psychology **16**:205-220.

Underwood, A. J. 1997. Experiments in Ecology. Their Logical Design and Interpretation Using Analysis of Variance. Cambridge University Press, Cambridge.

Vanclay, F. 2002. Conceptualising Social Impacts. Environmental Impact Assessment Review **22**:183-211.

Vayda, A. P., and B. J. McCay. 1975. New Directions in Ecology and Ecological Anthropology. Annual Review of Anthropology **4**:293-306.

Waitt, G., and K. Hartig. 2000. Ecologically Sustainable Fishing in Theory and Practice: Individual Transferable Quotas in Australia's South East Fishery. Australian Geographer **31**:87-114.

Walker, B., S. Carpenter, J. Anderies, N. Abel, G. S. Cumming, M. Janssen, L. Levbel, J. Norberg, G. D. Peterson, and R. Pritchard. 2002. Resilience Management in Social-Ecological Systems: A Working Hypothesis for a Participatory Approach. Conservation Ecology **6**: Online at: www.consecol.org/vol6/iss1/art14.

Walker, B., C. S. Holling, S. Carpenter, and A. Kinzig. 2004. Resilience, Adaptability and Transformability in Socio-ecological Systems. Ecology and Society **9**: Online at: www.ecologyandsociety.org/vol9.iss2/art5.

Walker, B., and J. A. Meyers. 2004. Thresholds in Ecological and Social-Ecological Systems: A Developing Database. Ecology and Society **9**: Online at: www.ecologyandsociety.org/vol9/iss2/art3.

Walters, B. B., A. Cadelina, A. Cardano, and E. Visitacion. 1999. Community History and Rural Development: Why Some Farmers Participate More Readily Than Others. Agricultural Systems **59**:193-214.

Walters, C. 1997. Challenges in Adaptive Management of Riparian and Coastal Ecosystems. Conservation Ecology **1**:1.

Ward, T., and E. Hegerl. 2003. Marine Protected Areas in Ecosystem-based Management of Fisheries. A Report for the Department of the Environment and Heritage. Natural Heritage Trust, Canberra.

Weber, P. 1995. Facing Limits in Oceanic Fisheries. Natural Resources Forum **19**:39-46.

Weber, R. P. 1985. Basic Content Analysis. Sage Publications, Beverley Hills.

Wiber, M. G. 2000. Fishing Rights as an Example of the Economic Rhetoric of Privatisation Calling for an Implicated Economics. The Canadian Review of Sociology and Anthropology **37**:267-288.

Williams, L. E. 2002. Queensland's Fisheries Resources: Current Condition and Recent Trends 1988-2000. QI02012, Department of Primary Industries Queensland, Brisbane.

Wilson, D. C. 2003. Examining the Two Cultures Theory of Fisheries Knowledge: The Case of Bluefish Management. Society and Natural Resources **16**:491-508.

Wilson, J. A., J. M. Acheson, M. Metcalf, and P. Kleban. 1994. Chaos, Complexity and Community Management of Fisheries. Marine Policy **18**:291-305.

Wingard, J. D. 2000. Community Transferable Quotas: Internalizing Externalities and Minimizing Social Impacts of Fisheries Management. Human Organization **59**:48-57.

Wismer, S. 1999. From the Ground Up: Quality of Life Indicators and Sustainable Community Development. Feminist Economics **5**:109-114.

Worthington, A. C., and B. E. Dollery. 2000. Can Australian Local Government Play a Meaningful Role in the Development of Social Capital in Disadvantaged Rural Communities. Australian Journal of Social Issues **35**:349-361.

Zeller, D., and E. G. Carmines. 1980. Measurement in the Social Sciences. *in*. Cambridge University Press, London.

Zvonkovic, A., S. Moon, M. Manoogian, and M. O'Dell. 1997. Adapting to Change: Fishing Marriages Over Time. Online at: http://seagrant.oregonstate.edu/sgpubs/Onlinepubs/g97007.html. A publication of the Adapting to Change: Patterns of Involvement Project Oregon Sea Grant, Oregon.

Appendix

A

The final survey used in this study is following.