Return to the Realm of the Kob Kings:

Social capital, learning, resilience and action research in a changing fishery

Gregory Lawrence Duggan

Thesis presented for the degree of Doctor of Philosophy

In the Department of Biological Sciences

University of Cape Town

March 2018

Supervised by Prof. Astrid Jarre and Prof. Grant Murray

Declaration

I know the meaning of plagiarism and declare that all of the work in this thesis, save for that which is properly acknowledged, is my own. This thesis has not been submitted in whole or in part for a degree at any other university.

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Date: 09/03/2018

Acknowledgement of funding

Financial support for this PhD and associated research was generously provided by the South African Research Chair Initiative (SARChI), funded by the Department of Science and Technology and administered by the National Research Foundation, via the South African Chair in Marine Ecology and Fisheries, Prof. Astrid Jarre. Opinions expressed, and conclusions arrived at, are those of the author and are those of the author alone and not necessarily to be attributed to the NRF or SARChI.

Acknowledgements

With sincerest gratitude, I would like to thank my supervisors, Prof. Astrid Jarre and Prof. Grant Murray for unwavering support and guidance throughout the research and writing processes.

The co-creating participants and experts who contributed so much to this work and whose experiences, challenges, and solutions inspired the research, are sincerely thanked for their willingness to engage and work with me. It is my sincerest hope that the processes and results developed as part of this thesis work will contribute to improving both their lives and communities.

Finally, to my family for their love and support through what has at times been a deeply challenging process for both myself and them.

To these and the many more colleagues and friends met along the way who have inspired and supported me throughout this process…Thank you.

Contents

List of abbreviations

CAPS – Curriculum Assessment Policy Statements

CSF – community supported fishery

CTD – Conductivity, temperature and depth (measurement device)

CURRA – Community-University Research for Recovery Alliance

CUS – Coasts Under Stress

DAFF – Department of Agriculture, Forestry, and Fisheries

DEAT – Department of Environmental Affairs and Tourism

EAF – Ecosystem Approach to Fisheries

FRAP - Fisheries Rights Allocation Process

MLRA – Marine Living Resources Act

SACTN - South African Coastal Temperature Network

SCIFR – Southern Cape Interdisciplinary Fisheries Research project

SES – Social-ecological system

SSFP - Policy for the Small-Scale Fisheries Sector in South Africa

SST – sea surface temperature

UTR – underwater temperature recorder

Abstract

Based on ethnographic fieldwork in the traditional commercial linefishery on South Africa's southern Cape coast, informed by social-ecological systems (SES) thinking, and directed by a participatory action research approach, the work facilitated the co-development of a series of applied responses to local challenges identified by research participants including commercial linefishers, school learners, teachers, and other local community members. The thesis is presented in four chapters, each focussing on a different challenge: marine water temperatures; school learning for social learning; fishers' organisations; and branding of linefish.

The objectives of the thesis are to explore the processes, constraints, motivators, and lessons learnt in addressing each of the four challenges drawing on four emergent themes: 1) trust and social capital, 2) social learning, 3) resilience and transformation, and 4) participatory action research/co-development.

The thesis underlines how participation leads to co-developed strategies to address realworld challenges. The work on water temperatures resulted in the co-development of a novel water temperature measuring device for deployment on commercial linefishing boats. However, despite initial successful deployment, fishers' time and financial concerns, paired with a short-term focus undermined the participatory process. The social learning and teaching work facilitated the co-development of a series of integrated teaching modules that addressed challenges observed in the school, transforming the approach to teaching, and laying the foundation for future community social learning. The work also raised the challenge of 'high stakes testing' which may constrain teacher participation.

The work on fishers' organisations revealed the role of leadership, competing economic and lifestyle foci, competence and political trust, as well as 'bonding', 'bridging', and 'linking' forms of social capital in the formation, maintenance and dissolution of these bodies. The research found that different forms of trust and social capital, paired with leadership, were critical to successful participation and collaboration throughout the fieldwork. Finally, the branding work resulted in an adaptation on the part of the fishers, but one which was constrained by and highlighted the economic influence of inshore trawling that continues to limit the extent of linefishers' adaptive strategies.

Chapter One: Introduction

The problems facing coastal communities and fisheries have both ecological and social components that interact in multiple and often unpredictable ways (Ommer et al. 2007; Ostrom 2007; Berkes and Ross 2013; Armitage et al. 2017). As such, the challenges arising from these interactions are often too messy and complex for simplistic solutions. Characterised as "wicked problems" (Rittel and Webber 1973; Conklin 2005; Jentoft and Chuenpagdee 2009), these persistent and complex challenges encompass social, ecological, climatic, political, economic concerns, and are not easily solved (Jentoft and Chuenpagdee 2009).

What are required in tackling these problems are approaches that attempt to account for and work with complexity, focussing, where appropriate, on fostering resilience, adaptation and transformation (Berkes and Jolly 2002; Folke et al. 2010; Armitage et al. 2017) as well as education and learning (Armitage et al. 2008; Armitage et al. 2011; Tidball and Krasny 2011; Johnson et al. 2012), action responses to actively address pressing social-ecological challenges (Adger 2003) and the social capital necessary to bring people together in order to act (Adger 2003; Chloupkova et al. 2003; Gutiérrez et al. 2011).

The findings of international research in coastal fisheries suggest the value of a systems approach to understanding and tackling complex social-ecological problems (Jentoft et al. 1998; Ommer et al. 2007; Ommer et al. 2012). The emergence of integrative and collaborative systems approaches to fisheries research and management since the late 1990s sought to remedy some short-comings of target resource-oriented, top-down management.

Social-ecological systems

In recent years, social-ecological systems (SES) thinking has emerged in response to the need for new ways in which to understand and work with the unpredictability, complexity, and change of coupled social and ecological systems (Folke 2006) as well as the need for a framework that enables scholars interested in specific elements of SESs to communicate concepts with one another (McGinnis and Ostrom 2014). Although not a management framework per se, SES thinking is nonetheless a valuable approach for those wishing to

understand, conceptualise and formulate responses to challenges arising in complex systems such as fisheries.

Early influential work in fisheries social-ecological systems was undertaken by Berkes and colleagues (Berkes and Folke 1998; Berkes and Jolly 2002; Berkes 2003; Olsson et al. 2004) who, in response to the perceived shortcomings of conventional resource management, sought to engage a wider variety of knowledge sources in the management of ecosystems and argued for the development of a framework for integrating knowledge. Intended to incorporate perspectives from different management systems, Berkes and Folke's (1998) early analytical framework was conceptualised to investigate the social structures and interactions that shaped management practices, and, critically, to begin to incorporate diverse local knowledge by understanding how local people interact with ecosystems based on their local ecological knowledge (Berkes and Folke 1998). In so doing, the work took steps towards working with multiple perspectives and integrating human and ecological concerns under an overarching framework.

In 2007, Ostrom laid out a framework within which to analyse social-ecological systems (SESs), identifying various key components and interactions within SESs that inform the development, structure, and attributes of the system (Ostrom 2007). The concepts outlined in this framework were intended to enable researchers from a range of natural and social science backgrounds to speak to one another across the full range of scales of social-ecological systems, from the highly localised to the much larger (McGinnis and Ostrom 2014). This integrative step is key, as without multiple integrated perspectives on complex problems, researchers are bound by disciplinary limits and prone to understand only limited aspects of the system such that misinterpretations of observed phenomena and changes may occur (Ommer et al. 2012). This a problem may be further compounded by a limited understanding amongst participants of available options (Ommer et al. 2012). The value of the SES framework in this case thus lies in its broad reach and incorporation of multiple disciplines and perspectives, for, following McGinnis and Ostrom (2014: 2) "if one is interested in understanding processes of use, maintenance, regeneration, and destruction of natural resources or humanly constructed infrastructures, then one is necessarily interested in a wide diversity of different processes going on either simultaneously or sequentially".

Schoon and Van der Leeuw (2015) distinguish contemporary SES thinking by three fundamental characteristics: the full integration of social and ecological perspectives into a coupled system; the presupposition that social-ecological systems are dynamic, unpredictable in their developments; and an inter/transdisciplinary perspective that seeks to account for complexity and dynamics. Intrinsic to this is the presupposition that social and ecological systems are in an iterative relationship such that change in one may have an effect on the other (Ommer et al. 2007; Binder et al. 2011; Park et al. 2012) with interactions taking place within a system that encompasses multiple internal scales (Perry and Ommer 2003; Ommer 2007). SES thinking thus sees humans as reintegrated into a richly complex system (Berkes and Folke 1998) encompassing multiple ecological and social actors.

Seeking to understand the interactive, iterative impacts of restructuring events on coastal communities, the seminal Coasts Under Stress (CUS) project, undertook a multi-scale programme conducted on the Canadian East and West coasts. Building on the work of a series of Canadian interdisciplinary fisheries reseach projects before it, and funded over a period of five years, CUS focussed on health, wellbeing and examining various interacting drivers and their outcomes (Ommer 2007). CUS was formulated as a series of comparative case studies across a wide range of scales, sectors, and contexts exploring, amongst other challenges, the impacts of multiple, multiscalar and interactive restructuring events, those "complex interactions among environmental, institutional, industrial, and social processes, which, in combination, affect human, community, and biophysical health" (Dolan et al. 2005: 196), that dramatically impacted upon the health and wellbeing of individuals, communities, and the ecosystem (Ommer et al. 2007). CUS's work examined the repercussions of these restructuring events with the team adopting an approach that further developed SES thinking into a broad trans- and interdisciplinary framework that acknowledges and works productively with the full range of complex social-ecological interactions (Ommer et al. 2007).

Building on the foundational approaches developed by the CUS team, the Community-University Research for Recovery Alliance (CURRA), a series of linked interdisciplinary research projects along the Newfoundland coast of Atlantic Canada, ran from 2007 to 2014. Framed within SES thinking, the project undertook to work collaboratively with local

communitiy members, organisations and other stakeholders in response to the negative impacts of restructuring events in the Newfoundland fishery as detailed by CUS (CURRA 2017a). The CURRA project suggested that emphasis be placed on revitalising both vulnerable fisheries and their associated communities (Neis et al. 2014). This community-centric collaborative and interdisciplinary approach resulted in the co-development of strategies formulated to address social-ecological challenges with a focus on well-being. CURRA's *Legacy* programme and, in particular, the *Curriculum for Recovery* (CURRA 2017b), which formulated free lesson plans for Grades 7-12 with a focus on developing a sense of stewardship and enthusiasm for students' local environment, is particularly pertinent to this thesis.

Following Ostrom (2009), one of the principal challenges facing SES research that looks at the success and failure of systems concerns understanding the interconnections between various spatial and temporal scales. The scales at which social and natural science research are conducted have traditionally been considerably different both spatially and temporally (Gibson et al. 2000), requiring that researchers develop nuanced, explicit ways of discussing issues of scale. The selected scale of a study, for example, influences researchers' ability to recognise "the drivers and responses of these systems to global changes" (Perry and Ommer 2003: 513). The task then, following Perry and Ommer (2003) is to effectively combine natural and social science scales of analysis in effective ways that shed light on interacting human and natural system, and their mutual impacts on one another. This suggestion also points to the risk of scale mismatches in social-ecoloigcal systems where "the scale of environmental variation and the scale of the social organization responsible for management are aligned in such a way that one or more functions of the social-ecological system are disrupted, inefficiencies occur, and/or important components of the system are lost" (Cumming et al. 2006: 3).

Discussing the role of adaptive co-management approaches in the building of resilient social-ecological systems, Olsson et al. (2004) suggest that cross-scale ways of understanding and working , address the challenge of misaligned scales by fostering experimentation, experience, and insight at different points of scale. However, such an undertaking still has significant challenges, for example reconciling specific behavioural observations with the broader underlying process by which they are informed (Perry and

Ommer 2003). Much of the work on social-ecological systems has typically focussed on the larger scale (Perry and Ommer 2003), however, the social component in such analyses is often under-researched and characterised by imprecise delineation of scales (Gibson et al. 2000), with less focus on the repercussions and alterations that result from disruptions to the social component of the social-ecological system (Perry and Ommer 2003).

Restructuring events may take place at the regional (Jarre et al. 2013), national and international levels (Perry and Ommer 2003; Perry et al. 2011). The work of CUS demonstrated the devastating impacts that these changes at broader scales may have at smaller scales. As such, Perry and Ommer (2003) suggest that smaller scales of social analysis, such as the level of the community, provide understanding of local conditions, motivations, and the needs of people, which in turn exert influence over the success of management policies on the ground. Moreover, following Ommer et al. (2007), policies formulated to cover national or even provincial scales often risk ignoring context-specific nuances, resulting in the marginalisation of local communities and producers. The result is the potential for failure at the point of implementation, pointing to the need for a thorough understanding of conditions at the level of the community (Ommer et al. 2007). Despite the scale of the community and the 'local' being important to social-ecological analyses (Perry and Ommer 2003), anthropology, with its focus on the micro scale of human interactions, has made little contribution towards SES research in the past. The value of the anthropological approach in this regard, however, is in providing observations and insight into the most intimate of scales, often the hardest to access and account for, and forming the basis of larger social networks. It is this focus on the smaller scale, from the individual up to the level of the community, to which this thesis turns its gaze while retaining an attentiveness to cross-scale dynamics.

South African fisheries policies

In line with international trends towards more inclusive fisheries policies, in 1998 the South African government enacted the Marine Living Resources Act (MLRA). This revised policy looked to adopt a more inclusive approach by balancing resource exploitation with ecological sustainability, participatory governance, and a redressing of historical imbalances (MLRA 1998). For decades, South Africa had sought to manage its fisheries via single-stock type assessments and a top-down approach. Single-stock type assessments and attendant

management structures have, however, been criticised for tending to perceive fishers in simplified economic terms, imposing generic “one size fits all” approaches (Finlayson 1994; Berkes 2009; Jentoft and Chuenpagdee 2009). This has often resulted in failure, with the management regime being at odds with the circumstances on the ground or trying to impose simplified approaches on inherently complex, shifting, and unpredictable processes which cannot be neatly mapped (Béné et al. 2011). Moreover, the lack of collaboration and participation from a range of stakeholders has served to marginalise some fishers from management processes (Gammage et al. 2017). As a result, the past three decades have seen a shift away from the single-stock model of management towards ecosystem-centric approaches (Shannon et al. 2004; Shannon et al. 2010) .

Building on the MLRA, in 2001 South Africa adopted a plan to implement an ecosystems approach to fisheries (EAF) by 2010 (DEAT 2005). An EAF takes a systems perspective and seeks to “balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries” (FAO 2003). The early support of an EAF on paper, and the transformation objectives of the MLRA, however, have had limited success on the ground in South Africa. Moreover, the participatory component of an EAF (McCord and Zweig 2011) requires that participants are willing and able to work together, but recognising that participation can be difficult to mobilise (Garcia and Cochrane 2005). In other words, where an EAF assumes that certain preconditions to be in place, reality on the ground is often different. Despite the need for and adoption of a systems perspective in its fisheries, wealthy industrial trawling companies and inequality remain dominant features of South Africa’s fisheries sector (Isaacs et al. 2007; Hara et al. 2014; Jarre et al. 2018). Limited positive change has been observed in the small scale or traditional commercial linefisheries, the focus of this thesis, since the end of the Apartheid era (Isaacs 2006; Sowman et al. 2014) and the social aspects of fisheries in particular remain under-researched in the country (Sowman et al. 2013).

Linefishing

The present work takes as its focus the traditional commercial linefishery (also known as the handline sector or linefishery). Although the small scale or subsistence linefishery utilises the same fishing methods, gear, targets the same species, and uses the same or similar

vessels, the commercial linefishery is distinguished by its primary engagement in commercial efforts and the use of individual rights (DAFF 2013). In what follows, unless otherwise stated, the terms linefishery or handline are used in reference to the traditional commercial linefishery.

A typical linefishing rig, known as a 'handline', is comprised of a length of nylon fishing line or 'gut' secured at one end to a thick piece of rounded wood approximately 20cm long by 10cm held in the hand from which the line is paid off or wound in, the wood serving as both rod and reel such that the line is wrapped around it. At the fishing end of the line, hook(s) and lead weights are attached with a trace, the arrangement being determined by the target species, current, wind, swell, sea surface chop, bottom terrain, and the type of bait used. Once hooked, the fish is pulled in with a hand-over-hand motion. Depending on the species, the fish is usually killed with a blow to the head from a short wooden club, or an incision in the gill area and placed in a storage hold. The boats themselves are either 'skiboats' or 'deckboats'. Constructed from wood and fibreglass, and powered by twin outboard engines, skiboats hold up to a maximum of 2 tonnes of fish. Crewed by 3 to 6 fishers including the skipper, they generally operate within 60km of the harbour and conduct mostly day trips, fishing mostly over reefs. Deckboats are larger vessels also constructed of wood and fibreglass. Although the same length, they have a considerably larger volume than skiboats with a broad deck, deep draft and much larger storage capacity of up to 5 tonnes. Powered by a single inboard motor, these slower vessels are increasingly used to travel greater distances to sea and, owing to their size, can overnight on the fishing grounds. Both skiboats and deckboats operate under the same traditional linefish commercial license issued by the fisheries section of the South African Department of Agriculture, Forestry, and Fisheries (DAFF) (DAFF 2013).

The small-scale and commercial traditional fisheries continue to play a vital role in South Africa's poorer coastal communities by offering both food and sources of income to fishery participants (Norton 2014). While some small scale and traditional linefishers have a voice in relation to government via official linefishers' organisations (Attwood et al. 2013), a legacy of government marginalisation of these fisheries (Sowman 2011; Sowman et al. 2014) and resultant mistrust between fishers (Gammage et al. 2017) and government managers and scientists (van Zyl 2008) renders collaborative efforts difficult. Partnerships such as the

Responsible Fisheries Alliance, consisting of WWF South Africa, BirdLife South Africa and several large fishing industry companies, have sought to foster collaboration with regards to ecological well-being objectives in South Africa's EAF. However, much of this effort has focussed on the export-based, mechanised fisheries (McGregor 2014) and as such, the traditional linefishery remains overlooked (Sowman et al. 2014). The South African government has taken steps towards redressing past inequalities via the promulgation of a Policy for the Small Scale Fisheries Sector (SSFP) (DAFF 2012; DAFF 2015), formulated with respect to small scale subsistence fishers along the South African coastline. The SSFP places an emphasis on economic transformation and food security (DAFF 2012). However, the SSFP will also potentially reinforce divisions within the linefishery by asking fishers to identify as either commercial or subsistence linefishers. Further, the SSFP will enable participants to harvest a broad range of marine species, many of which are shared with the commercial linefishery (DAFF 2012) and as such, will potentially place small scale fishers' collectives in both market and resource competition with the commercial linefishery. Moreover, competition may be further exacerbated as the SSFP collectives will operate either in or near communities with established commercial linefishing practices.

On December 31st 2013, a Fisheries Rights Allocation Process (FRAP) in the commercial linefishery further threatened the fishery at the national level by bringing massive reductions in licenses (Moolla 2013; Moolla 2014), resulting in legal action between linefishers and DAFF and furthering tensions between historically marginalised fishers and the Department. In the southern Cape coastal region in particular, the challenges facing the commercial linefishery have been complicated over the past decade by regional ecological regime shifts (Blamey et al. 2012; Blamey et al. 2015), declining catches (Winker et al. 2014), and resource competition from inshore trawling (Greenston 2013). Further, several of the region's coastal communities suffer low levels of education and high levels of unemployment (STATSSA 2011a; Lehohla 2012; Gammage 2015).

A complex web of interacting social and ecological drivers thus present a dynamic challenge to participants in the southern Cape's commercial linefishery, many of whom operate in rural settings. It has been suggested that rural fishing communities, particularly when geographically isolated and reliant on marine ecosystems, are vulnerable to change or disruption in the social-ecological system (Bennett et al. 2014; Folke 2006). Linefishers are

bound by license conditions to operate within specific geographic regions, and this, combined with the high costs of transport, limits their ability to shift fishing grounds. Where small-scale fishers' efforts are limited by policy or other restrictions to targeting local resources, disruptions at a larger scale in the form of policy, environmental, or economic change may have unforeseeable knock-on effects at the lower end of the scale at the level of the community or individual (Folke 2006; Ommer 2007). In this regard, declining target species in the local fishing grounds, for example, may have significant ramifications for linefishers.

A recent related study in the region as part of the southern Cape Interdisciplinary Fisheries Research (SCIFR) project, of which this thesis forms part, found that linefishers in some of the important fishing communities in the region retain a high degree of resilience, which has become a maladaptive characteristic by limiting their ability to adapt to a changing social-ecological system (Gammage 2015). SCIFR was established to address three broad interrelated questions: how natural and social changes in the southern Cape are shaping and interacting with marine social-ecological systems; how selected natural resources users in the region respond to and shape change in their region; how knowledge of the current state of the social-ecological system can be used to build more resilient systems. As a contribution to the SCIFR project, the objective of the thesis was to address the SCIFR questions by way of a series of focussed case studies emerging from four specific research questions detailed below.

Research questions

Given the current state of the South African linefishery, the work set out to address four core research questions introduced below. Each of these questions was addressed via a dedicated chapter, described in further detail later in this introduction. The selection of each research question discussed below was based on observations from prior scoping fieldwork conducted in the southern Cape, where certain opportunities, needs, challenges and strategies were observed. Of these, several were recurrent and prominent, coming to influence the development of the thesis such that the research questions and choice of case studies was deliberately informed by conditions in the field.

Question one: water temperatures

The first question concerns a shared interest and need for water temperature data in the inshore region of the Agulhas Bank on the part of both linefishers and researchers and asks: given this shared interest in and need, might fishers and researchers be brought into conversation via a collaborative co-design process with fishers measuring water temperatures at sea?

Question two: schools and learning

The second question emerged from observations and interviews in two rural underprivileged schools in the southern Cape region and asks: working to address perceived shortcomings in the national school's curriculum, is it possible to initiate conversations around topics related to the local impacts of climate change and changes in the fishery, and social learning to improve adaptive responses to these challenges at the level of the school and community despite a persistent legacy of mistrust of outsiders?

Question three: fishers' organisations

The third question arose following the 2013 FRAP and the subsequent formalisation or reaffirmation of local linefishers' organisations in response to the crisis. Observing how one organisation failed where its neighbour succeeded, it asks: what are the reasons underpinning the relative success and failure of the neighbouring linefishers organisations and what lessons might be learnt from these?

Question four: branding against financial control

In light of a legacy of financially dominant buying practices by fish buying middlemen affiliated to inshore trawling companies in the region, and drawing lessons from successful fishers' community supported fisheries (CSF) collectives around the world, the fourth question asks: what is the viability of re-branding handline-caught fish in differentiating linefishers' catch, and is this a sustainable strategy to weather the storm of challenges facing their livelihood?

In addition, all four of the central research questions described above address aspects of the SCIFR Project questions through practical engagements with the marine social-ecological system in the southern Cape. By way of an exploration of marine water temperatures, social learning, and the branding of linefish, for example, research questions one, two and four

speak to the SCIFR Project's focus on exploring how natural and social changes shape and impact on the marine social-ecological system. Further to this, research questions two, three and four relate to SCIFR's exploration of how local natural resources users in the region respond to and shape change in their region by examining how people learn and interact with the social-ecological system of which they are a part. Lastly, by working closely with local people to understand their knowledge and interactions, as well as drawing on their knowledge to inform practical solutions, all four of the central thesis research questions speak to the SCIFR Project's question of how knowledge gathering pertaining to the current state of the system may lead to improved resilience.

Central themes

Working within a social-ecological systems perspective, the work details a series of practical, participatory action strategies for addressing the above questions. In so doing, four prominent research themes emerged. These were observed at various stages throughout the research and were evident in different combinations in addressing each research question. Three of the themes are conceptually-rooted, being trust and social capital, social learning, and resilience and transformation. The fourth theme is methodological in nature, and centres around participatory action research and the process of co-development. Each of these themes is pertinent to the SES perspective in that each addresses elements of the complexity required to tackle challenges in the social realm of the social-ecological system. The interdisciplinary nature of the SES approach afforded an opportunity to draw from a range of disciplines, concepts, and methodological approaches in the social sciences. The complex nature of the challenges identified in the field sites is reflected in the unification of concepts in the thesis that are not often brought into complementary contact with one another. A resilience perspective, for example, has been shown to be critical in addressing challenges in SESs (Berkes and Jolly 2002; Armitage et al. 2008; Folke et al. 2010). Social learning is integrally tied to systems thinking in that it enables people to better understand complexity (Johnson et al. 2012) and thereby improve their capacity to act, adapt or transform the system (Cundill et al. 2014; Budwig 2015; Lotz-Sisitka et al. 2015). Social capital enables collaboration between people to enact these strategies (Adger 2003), and a participatory action approach to research can serve to facilitate social learning (Greenwood

et al. 1993) and the creation of knowledge and skills empower people to act (Brydon-Miller et al. 2003; Bradbury-Huang 2010).

Theme 1 Social capital and trust

In the context of climate-related change, social adaptive capacity is in constant flux, constituted through the interactions between people and shaped by context (Pelling and High 2005).. In working with social-ecological systems then, understanding the ways in which social adaptive responses to change are shaped is critical. It has been suggested that the concept of social capital is a useful tool in understanding the social bonds and interactions that in turn shape adaptive responses in both individuals and groups (Pelling and High 2005). Notions of trust are intimately linked with social capital and it is difficult to consider the one concept without the other. The current work thus examines concepts and instances of trust and social capital in the commercial linefishery of the southern Cape insofar as they influence social adaptive capacity.

Definitions of social capital range along a spectrum from, on the one hand, emotional and moral values focussed on goodwill and reciprocity (Purdue 2001), to obligations and favours enforced through shared values and cultural norms (Coleman 1988 in Purdue 2001) and on to a more utilitarian, econocentric outlook, with Bourdieu (1986 in Purdue 2001: 2214) **s**uggesting simply that social capital emerges from to "the personal resources individuals derive from membership of a group". Contemporary definintions have sought to resolve the tensions between the social and economic roots of the term found in these earlier definitions by integrating them with notions of trust and democracy (Newton 2001). Adger (2003 in Bennett et al. 2014: 2), for example, defines social capital as "relationships built on trust, networks, and reciprocity, and the resultant willingness and ability of groups to act collectively" – a social bonding agent that both creates and sustains productive groups, contributing towards cooperation both within and between these and other groups (Grafton 2005). Similarly, the Organisation for Economic Co-operation and Development (OECD) (2007: 102) suggests that social capital emerges from the "links, shared values and understandings in society that enable individuals and groups to trust each other and so work together". Where these two definitions are premised on values and trust, however, Gutiérrez et al. (2011: 388) reconceptualise social capital broadly in more utilitarian terms as

"a buffer against changes in institutional arrangements, economic crises and resource overexploitation, and (fostering) sustainable co-management systems".

Drawing from the results of 50 social capital surveys around the world, Scrivens and Smith (2013) suggest that in the face of vulnerability, strong networks and allegiances motivate people to become politically engaged. Social networks in turn bolster the resilience of vulnerable groups (Chloupkova et al. 2003; Pelling and High 2005) and Putnam's (2000) work demonstrates a strong link between social capital and political and economic prosperity, both of which have been shown to be influential factors in the resilience of communities (Plummer and Armitage 2007; Berkes and Ross 2013).

Further to the local benefits of social capital, the linking of local knowledge with broader governance regimes by incorporating it into management has also been suggested as contributing towards improvements in ecological wellbeing (Stoll et al. 2015). However, hierarchies of power, failed relationships and resulting mistrust between fishers, managers, and researchers often complicate collaborative efforts and the transfer of knowledge in such undertakings (Kaplan 2004; Mackinson et al. 2011; Jacobsen et al. 2012; Norton 2014). Seen in this light, within a SES perspective, a focus on social capital is useful in understanding aspects of social adaptive capacity, particularly given the latter's impact on the resilience of social-ecological systems (Brown and Westaway 2011; Nelson 2011; Bennett et al. 2014).

In the above definitions the concept of trust is raised regularly as a crucial component in the creation, maintenance, or destruction of social capital. Indeed, one of the most prevalent and recurrent themes emerging from the fieldwork concerned ideals and issues of trust. As with so many such concepts, the fleeting, subjective, and dynamic nature of trust renders it difficult to define or measure. The conventional notion of interpersonal trust suggests that it is formed and maintained on the basis of values such as reciprocity, honesty, integrity and a shared history, resulting in 'goodwill' between people. This goodwill trust has been defined as "an emotional acceptance of the moral commitment of the other not to exploit vulnerability" (Purdue 2001: 2214). There is a second form of trust, observed during the fieldwork, common in the fishery and premised on a belief in the ability of others to "get the job done". Defined by Purdue (2001: 2214) as 'competence' trust, this is a confidence "that the other person or organisation has the capability to control risk by meeting their

commitments". Despite the value of social capital and trust to research into social interactions, the complexity, variability, and fleeting nature of these facets of human interaction have consistently proven difficult to measure (Chloupkova et al. 2003; Scrivens and Smith 2013). Given this difficulty and the objectives of the research, the work seeks to understand how the different forms of trust and social capital that people engage with inform their adaptive responses to change, variability and vulnerability.

Theme 2 Social and situated learning

It has been suggested that learning is an integral component of a resilient social-ecological system, contributing to the adaptive capacity of social actors within that system (Béné et al. 2014) as well as their ability to overcome maladaptive resilient features (Lotz-Sisitka et al. 2015) and to transform the system when needs be (Armitage et al. 2017). In particular, social learning has been suggested as representing the possibility to develop and speed up experience and knowledge-building to deal with change and uncertainty across groups and scales (Pahl-Wostl et al. 2007). Further, adopting a systems thinking perspective is integral to successful social learning insofar as it enables participants to recalibrate their perspective to appreciate and comprehend the complexity of those issues facing a SES (Johnson et al. 2012).

Importantly, social learning is not simply a process of knowledge accumulation, but rather one of understanding how best to apply knowledge to a given situation. In other words, social learning is about learning not just *about* the environment, but *for* it, focussing on participation, with learning representing knowledge in practise (Pahl-Wostl et al. 2007). In addition, it is important to acknowledge and work within the governance structures that inform the characteristics, type, and opportunities for social learning, with restrictive systems political, bureaucratic, or economic systems, and resources scarcity impacting the scope of possible social learning activities (Pahl-Wostl et al. 2007). As such, proper social learning requires long-term engagement and an understanding of the dynamic local context, with an adaptable learning structure informing the process.

Definitions of social learning conventionally centre around a change in understanding in an individual or a group through social interations (Reed et al. 2010). In the South African context, recent work by McGregor (2014) focussed on the value of social learning, drawing from Keen et al.'s (2005: 4) definition of social learning as "collective action and reflection

that occurs among individuals and groups as they work to improve the management of human and environmental interrelations". Reed et al. (2010) suggest social learning should encompass three central tenets: firstly, a demonstrable change in understanding amongst participants; secondly that this new understanding goes beyond individual boundaries to become embedded in the larger local community, or parts thereof; and thirdly, that it takes place via social interactions embedded in a local network or community. Conventional approaches to social learning focus on management objectives (Berkes and Jolly 2002; Pahl-Wostl et al. 2007; Reed et al. 2010) and working with adults (Krasny et al. 2009). However, the present work expands this focus, taking heed of Krasny et al.'s (2009) contention that little attention has been paid in research to the role of younger people, by actively working with schools as foundational incubators for further and future social learning in support of resilience and the building of critical skills.

Following Johnson et al. (2012), those wishing to pursue social learning should pursue four outcomes: the first of these concerns fostering of a systems-thinking perspective in which people start to consider different facets of a problem from a range of scales; reinforcing this systems perspective, the second outcome should be the development of an appreciation of others' perspectives; thirdly, the forging or furthering of deeper social relations and interactions enables participants not only to appreciate the perspectives of others, but contributes to the formation of a stronger collaborative base from which to take action; building on this collaborative base, the fourth outcome of social learning should be a participatory processes that result in behavioural changes amongst individuals and the group. In sustaining the process, the authors suggest that frequent, long-term engagement between researcher(s) and participants is also key (Johnson et al. 2012).

Lotz-Sisitka's work in South Africa on environmental education stresses the importance of recognising the uniqueness of a particular community or situation and tailoring responses to suit this (Lotz-Sisitka 2004). The author suggests that a traditionally poor understanding of the links between education, participation, awareness and capacity-building has hindered large-scale sustainability frameworks and that the dominant focus on institutional rather than social capacity requires a change that looks to social concerns and the role of education in facilitating action (Lotz-Sisitka 2004). The author's more recent work on teacher education cautions that a failure on the part of teachers to fully understand

concepts related to climate change often results in their failure "to consider what can be done about it" (Lotz-Sisitka 2015: 32). Further to this, the dominant focus on education *about* the environment (i.e. raising awareness) continues to hinder social innovation and responses *for* the environment (Lotz-Sisitka 2015). Considering this challenge in relation to the Curriculum Assessment Policy Statements (CAPS) - the prescribed curriculum for South African government-funded schools – and the need for a more engaged and responsive education system, Lotz-Sisitka (2015: 32) argues that a "curriculum that simply aligns with the CAPS appears to be inadequate".

Critiquing the predominant focus of sustainability science on resilience and adaptive capacity, Lotz-Sisitka et al. (2015: 73) suggest that South Africa adopt a transformative approach to education, contending that "to break with maladaptive resilience of unsustainable systems it is essential to strengthen transgressive learning and disruptive capacity-building". Similarly, the IPCC stresses the importance of transformative learning at the level of the local as means of engaging system-wide responses to climate change (IPCC 2014), and Armitage et al. (2017) suggest that learning is a key condition in bringing about transformative change.

Arguing that social learning may act as a transformative force in sustainability thinking and action, Budwig et al. (2015) suggest that intentional transformative learning must display three fundamental characteristics. Firstly, it must be situated: determined by place, informed through interactions, and shaped by participation. In other words, interaction with the broader community beyond textbooks and the classroom is key (Budwig 2015). Secondly, it must be 'deep' and involve more than rote learning of facts - students need to apply concepts, engage in practise, and improvise using their knowledge to understand and adapt to a challenge (Budwig 2015). Thirdly, learning must be a developmental process whereby students begin with a particular capacity and worldview, and through the learning process, expand their knowledge, capacity and so develop expertise (Budwig 2015). A distinction is noted here between 'routine' expertise - the ability to repeat a process towards an unaltering end goal - and adaptive expertise, wherein learners are able to devise and adapt strategies to address variable and shifting goals (Budwig 2015). The goal for transformative learning then, should be to provide learners with situated, deep, and developmental learning that improves their adaptive responses.

Following Brundiers and Wiek (2013) sustainability education and social learning exercises often fall short of their goals by not fully integrating participatory components in a practical manner. Further, in their review of contemporary environmental education training literature, Ban et al. (2015) found that lectures alone are insufficient means of conveying the nuances and importance of environmental issues to students, and that more emphasis needs to be placed on active engagement between learners and the physical environment as a means of reinforcing learning and understanding. Situated learning, also called experiential learning or place-based learning (Hilburn and Maguth 2011) seeks to achieve this by focussing on learner interaction with the environment in order to garner a better sense of circumstances. Premised on the notion that learning "occurs through recursive interactions between individual learners and their social and biophysical environments" (Krasny et al. 2009: 1), situated learning exercises thus encourage students to turn to and learn from their immediate environment, resources and community via practical exercises (Hilburn and Maguth 2011). In so doing, the surrounding natural world becomes a source of intrigue, students gain insight into the challenges facing their community, becoming better informed and may actively contribute towards solutions (Hilburn and Maguth 2011). As such, concepts like resilience may become something students are actively encouraged to foster in the social-ecological system in which they live, rather than remaining abstract (Krasny et al. 2009). In this way, situated learning can form a foundation upon which to initiate social learning, sharing the goal of motivating a change in behaviour through education embedded in, and informed by, challenges in the local environment (Krasny et al. 2009) and as such has formed the foundation upon which the learning component of this thesis has been developed.

Theme 3 Resilience and transformation in SESs

Within the SES thinking paradigm, several sub-disciplines have evolved to explore critical elements of complex system dynamics. In particular, resilience thinking has emerged as a dynamic and evolving constellation of interrelated concepts encompassing adaptation, vulnerability, and adaptive capacity (Smit and Wandel 2006), each having applicability in both the social and ecological spheres (Gallopin 2006). Although the thesis is grounded within the broader SES thinking paradigm, it borrows at times from specific resilience

concepts such as adaptive capacity and vulnerability to tackle concepts which were pertinent to the field sites and fieldwork.

Resilience has been posited as an essential characteristic of a robust social-ecological system (Walker et al. 2004; Folke 2006; Folke et al. 2010; Berkes and Ross 2013). Emerging as a perspective for understanding population interactions in ecology in the 1960s and 1970s, the concept was strongly influenced by the work of C.S. Holling (1961; 1973) on the stability of ecosystems and their ability to withstand disturbance and resist change (Walker et al. 2004; Folke 2006). Contemporary resilience thinking, grounded in a systems perspective, places emphasis on the reliance of resource-dependant people on the environment and the subsequent interactions that unfold, thereby serving to highlight the linkages between the social and ecological in social-ecological systems thinking (Béné et al. 2012). In other words, resilience thinking provides a perspective from which to analyse the given system as a complex adaptive one in which interacting factors shape and impact upon the system's ever-changing nature (Walker and Salt 2006).

Adapting the earlier ecological concept of resilience to a social context, Adger's work provided a definition of what the author termed 'social resilience' or "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (2000: 347). Later work (Walker et al. 2002; Olsson et al. 2004; Walker et al. 2004; Folke 2006; Folke et al. 2010; Berkes and Ross 2013) brought resilience thinking into the realm of general SES thinking where it was adopted by some social theorists. The concept of social resilience today highlights the dependence of social groups on the health of their surrounding environment, correlating resilience of the natural sub-system with the resilience, adaptive capacity, and vulnerability of dependent human resource users. Where people are reliant on a resource such as fish, for example, even small disruptions in the natural subsystem may have overwhelming repercussions in the social one and vice versa (Ommer et al. 2007).

Contemporary resilience thinking for SESs expands the term to include "…the opportunities that disturbance opens up in terms of recombination of evolved structures and processes, renewal of the system and the emergence of new trajectories" (Folke 2006: 259) and encompasses three broad, interacting pathways. The first of these is described via the terms absorptive capacity, persistence or resistance, and describes a scenario of coping in which

mechanisms within the system buffer against shock or change without the need for an alteration of the status quo (Béné et al. 2012). This absorptive capacity manifests as a stable system absorbing disturbances and maintaining its function with little to no change (Walker and Salt 2006). The second pathway, flexibility or incremental adjustment, suggests a gradual, subtle alteration or reorganisation of the system or elements within the system to cope with the impacts of drivers of change (Béné et al. 2012) and is informed by "the adaptability of a system to change" (Bennett et al. 2014: 2). Cork (2010), drawing from fieldwork observations from both social and ecological settings, suggests that where complex adaptive systems experience disturbance, subtle changes are manifested in different elements of the system such that the post-disturbance system may display new characteristics. Lastly, transformation describes a fundamental change in the system (Folke et al. 2010; Pelling and Manuel-Navarrete 2011; Béné et al. 2012; Pelling et al. 2015; Armitage et al. 2017) into an altogether new and different form.

Adaptability and vulnerability are key terms in describing the resilience of a SES (Walker et al. 2004; Gallopin 2006; Folke et al. 2010). Adaptability, also referred to as adaptive capacity (Gallopin 2006), describes the ability of the system learn to adjust to disruptions both within and outside of the system in order to remain intact (Folke et al. 2010; Armitage et al. 2016). Where human actors look to build resilience, there exists, following Folke (2006: 259), a "dynamic adaptive interplay between sustaining and developing with change". This tension between a SES's ability to change or reorganise whilst persisting stands in contrast to earlier ecological definitions of resilience that made little or no allowance for reorganisation. Adaptation itself can be defined as "a proactive response strategy that seeks to reduce the vulnerability of a community to a change" (Bennett et al. 2015: 3) and the degree to which a SES is able to adapt is in turn characterised by both its adaptive capacity and vulnerability (Smit and Wandel 2006).

In recent years, there has been some research into understanding the self-organization and learning that result from a disturbance event, the impact of which is "crucially dependent on the self-organising capacity of the complex adaptive system" (Norberg and Cumming 2006 in Folke 2006: 259). In particular, a field of research has begun to focus on 'social adaptive capacity', or "the ability to respond to challenges through learning, managing risks and impacts, developing new knowledge and devising effective approaches" (Marshall et al.

2010). However, within the adaptation field the social roots of adaptation and vulnerability remain under-researched (Wise et al. 2014).

Vulnerability has been defined as "the susceptibility of an entity, such as an individual, group, sector, community or country, to an endogenous change, stressor or threat and the ability of the entity to recover from that threat" (Bennett et al. 2015: 2). Just as SESs are dynamic, the vulnerability of a system fluctuates in accordance with both the changing characteristics of the system over time as well as the nature of disturbances (Brooks et al. 2005). The process of adaptation may itself introduce new vulnerabilities (Janssen et al. 2007). In this way, vulnerability is contextually dependent and may be positively or negatively influenced by change or intervention in the system and where vulnerabilities overwhelm the system, a new state may emerge (Cinner 2011). Adaptive capacity, resilience and vulnerability are thus linked such that an improvement in adaptive capacity may lead to improved resilience and hence a reduction in the vulnerability of the system, or subsets of that system (Brooks et al. 2005).

An emergent body of work has begun to focus on understanding what happens when the adaptive capacity of the system breaks down. One such work is *Governing the Coastal Commons* (Armitage et al. 2017), a book which adopts a SES perspective in exploring resilience and transformation in coastal communities. The work takes as its focus the threats and drivers of change facing these communities, and the responses that originate to bring about transformative action.

Transformation occurs when pressures exceed ability of the system to maintain its original state, with the fundamental characteristics of the system thus altering into an entirely new one (Walker et al. 2004). Armitage et al. (2017: 9) define transformation accordingly as the "relatively rapid and fundamental shifts in the state of the human and/or natural world, whether they involve naturally occurring or human-induced change". The authors further highlight the importance of *deliberate* transformations, as fundamental changes brought about purposefully through human actions, focussing their work on three prominent forms: collaboration, participation and shared learning; governance components such as policy and co-management; and entrepreneurial action to improve participants' livelihoods (Armitage et al. 2017). For Folke et al. (2010) the determinants impacting upon the transformation of a

system – either deliberate or forced – are themselves constrained by the SES's capacity to alter its state into an entirely new one.

Transformation then is a radical, and fundamental response that occurs either preemptively or forcibly when the system's capacity to absorb disturbances is exceeded to the extent that resilience or adaptive capacity are lost or break down. Where communities or groups enact or are constrained by coping mechanisms that limit their capacity to transform in response to complex drivers in the system, flexibility and innovation are limited (Béné et al. 2012). Thus, in instances where such changes threaten livelihoods, absorptive or adaptive capacity are not enough. Moreover, these responses limit communities' ability to engage appropriately and actionably with the challenges in the social-ecological system (Béné et al. 2012). The capacity to engage in deliberate transformation then, seeks to enable people to engage more deeply with the social-ecological system by actively interacting to manifest change rather than passively experiencing or slowly adapting to it.

It is important to note that all of the concepts discussed above are characterised by dynamicism and mutability; as conditions change at the various scales of the SES, so too do its adaptive capacity, vulnerability, resilience, and transformability. Referring to the concept of resilience as persistence, Davidson (2010: 1145) suggests that "when resilience is no longer an option, the nature of collective agency can define the ensuing adaptation or transformation tajectories". Here Davidson raises the role of social action in response to change. However, despite the recognition of the value of a systems perspective to tackling complex problems, recent studies in the social sciences have cautioned that the ecological foundations of contemporary SES, and resilience thinking in particular, limit its applicability to social considerations (Davidson 2010; Cote and Nightingale 2012). Addressing concerns around the predominant focus of resilience thinking on ecology, Armitage et al. (2012) suggest that while further augmentation of research approaches to understanding the social impacts of environmental changes are necessary, no single approach can adequately perform the task. Rather, it is suggested (Armitage et al. 2012) that multiple hybrid approaches be deployed that combine social and ecological considerations to explore the complexity of human-nature interactions. To this end, the authors adopt a 'social conception of well-being', an approach developed earlier by the Coasts Under Stress project (Ommer et al. 2007), premised on an understanding of wellbeing being both process and

outcome. Like CUS, the authors use this conception of wellbeing in combination with a resilience perspective to explore the limitations of ecological resilience concepts when applied to social challenges, and the benefits of combining resilience and well-being perspectives towards a social-ecological perspective.

Cote and Nightingale (2012) also note the shortcomings of resilience research that attempts to understand social issues from a perspective grounded in ecology. In addressing these concerns, and echoing Davidson's (2010) sentiments, the authors argue that the issue is one of scale, suggesting a shift in research focus away from institutional structures towards an understanding of the "processes and relations that support these structures" (Cote and Nightingale 2012: 480).

Much of the contemporary adaptation literature focusses on implementation, however, it tends to focus on contexts with clearly identified decision makers and unambiguous goals, assuming that the prevailing governance regimes are conducive to adaptation (Wise et al. 2014). Further to this, Wise et al. (2014), in their comprehensive review of contemporary adaptation research, found that despite the focus on discussions of implementation, there was little reporting of real-world implementation with tangible results, a finding which strongly resonates with the action-centric approach adopted in this thesis.

Theme 4 Participatory action research and co-development

Armitage et al. (2011: 996) have suggested the value of problem-centered knowledge co-production, or "the collaborative process of bringing a plurality of knowedge sources and types together to address a defined problem and build an integrated or systems-understanding of that problem". Considering the challenges faced on the ground in the field sites, the thesis adopts this collaborative approach to problem-centered knowledge co-production and pairs it with a participatory action-based approach to research, extending participation into the fieldsites by working local people including fishers, high school (Gr 7-9) learners (the equivalent of the 'middle school' system in North America), teachers and community members, to formulate responses and strategies appropriate to their context and experience. In this way, it moves beyond viewing research participants as data repositories from which to extract information (Stanley and Rice 2003), reframing participants as co-creators of knowledge in the formulation of research questions and end

products within a participatory action research paradigm (Raicevichet al. 2011; Trimble and Berkes 2013).

Action research developed out of the notion that social science developed as a tool for adressing social problems (Greenwood et al. 1993), placing emphasis on using theory to inform good practice in the support of community wellbeing (Brydon-Miller et al. 2003). Similarly, participatory research also embodies an action approach with a focus on local context and challenges, incorating local actors throughout the research process with the intention that the results of the research directly benefit the community (Trimble and Berkes 2013).

Marrying these approaches, where action research relies on the researcher to drive the process, participatory action research expands this by looking to incorporate participants as more fully involved, co-contributors (Brydon-Miller et al. 2003). As such, participatory action research looks to foster and coordinate collaboration between a range of different actors, knowledge- and power positions (Stokols 2006). Armitage et al. (2017) stress the importance of participation which incorporates collaborative processes as a means of building social capital. The thesis adopts this perspective as well as Bradbury-Huang's (2010) suggestion that participatory action research be guided by practical concerns, look to co-produce strategies with local people, and thus contribute to their capacity to adapt, or transform their situation responsibly.

A hallmark of the participatory action research paradigm is that it encourages collaboration and democratic participation by all participants with the researcher acting as a facilitator and mediator (Brydon-Miller et al. 2003; Simms 2013). Further to this, the approach strongly supports the incorporation of local knowledge in formulating collective responses to local problems and encourages the use of multiple and diverse theories and methods so as to approach problems from different angles with relevant tools (Simms 2013). Such work involves planning and execution with later reflection informing further planning (Simms 2013). It concerns itself with education and learning, encouraging participants to gather and share knowledge in the creation of new strategies for addressing complex problems (Brydon-Miller et al. 2003; Simms 2013). Lastly, in undertaking participatory action research, analysis and understanding should be linked to social action such that results are rendered meaningful to all participants, be they researchers or community members (Greenwood et

al. 1993). The use of these participatory action-based methods throughout the work meant that the research agenda and central research questions were influenced by local challenges and needs, and that the strategies developed were undertaken with the full involvement of research participants at all stages.

In conducting action research, participation ranges along a spectrum with minimal levels of consultation on the one end, and full engagement with research participants as co-creating collaborators on the other (Bradbury-Huang 2010). A challenge facing the work was how to focus, where appropriate, on the co-design/development side of the spectrum. To this end, the approach adopted was informed by product co-development (Neale and Corkindale 1998; Fliess and Becker 2006) and the related concept of 'lead users' (Morrison et al. 2004; Jeppesen and Laursen 2009; Ozer 2009). The decision to incorporate these concepts and approaches into the research was informed by their development of practical guidelines for incorporating participants' knowledge and insights into strategy and associated products.

Lead users are specifically those individuals at the cutting edge of a market, positioned such that they are highly incentivised to both promote and make use of the latest innovations (Morrison et al. 2004). Following Harhoff et al. (2003), product end-users are often responsible for innovations that manufacturers later pick up on, their adoption leading to further product refinement and market success. The lead user concept positions these innovators at the forefront of a co-devleopment process which sees them consulted at critical points throughout the planning, design, and prototyping phases from the outset with multiple feedback sessions to refine the ultimate design of the final product (Fliess and Becker 2006). Co-design or –development looks to integrate supply and demand to the extent that the division between producer and end-user blur. Importantly, research has shown that, due to the motivation for an improved end-product, lead users often feel compelled to collaborate or reveal innovations for free, understanding the benefits they will accrue from contributing their knowledge (Harhoff et al. 2003). As an example of this, the under-resourced nature of the two schools as part of the integrated teaching modules positioned them as highly incentivised to innovate and contribute towards the module design and development.

Before engaging in participatory action research, it is necessary to consider the influence of those local actors who hold the potential to influence participation. In a study of 130 global

co-managed fisheries, Gutiérrez et al. (2011) found that leadership was the most influential characteristic informing their success. More specifically, the authors found that leadership that looked to build social capital rather than impose top-down management structures on collaborators was a far more effective tool (Gutiérrez et al. 2011). In other words, competent leadership itself leads to the generation of social capital by first establishing trust between people which in turn develops into social bonds and linkages (Tansley et al. 2012). Similarly, Armitage et al. (2017) suggest that leadership is vital in a transformative setting building trust and entrepreneurial capacity. In particular, the reputation of a leader is critical in their becoming accepted as such in a community or group (Purdue 2001). In the thesis fieldwork, the leaders were observed at points as displaying a complementary combination of transformational and transactional leadership (Purdue 2001). The former relates to leadership that builds trust amongst members through goodwill such as involving them in decision-making, and the latter to a belief in the leadership based on proven competence as a reliable representative of the group's interests (Purdue 2001). Here accountability is key, and corollary to this, a consistent understanding and inclusion of others' input in decision-making (Purdue 2001).

Methodology

Before being able to act appropriately in response to the challenges of a particular context, the establishment of collaborative partnerships is essential (Simms 2013). In addition to the overarching SES thinking which informs the work, ethnographic participant observation methodology formed the foundation of data collection in the field as well as a means of establishing collaborative relationships. As an approach to data collection and fieldwork interactions, it sees the researcher engaged in the daily lives of research participants for long periods of time – in the case of the thesis fieldwork up to six months at a time over a period of 5 years (2013-2017) - enabling the researcher to "get close to people" (Gans 1999: 540), building rapport, trust, and garnering a deeper understanding of their context and challenges that conventional short-term approaches such as surveys are prone to miss. Having a personal history in the region spanning three decades, and having initiated ethnographic research there in early 2010 as part of MSocSc dissertation work (Duggan 2012) have contributed considerably to this trust building. Despite the obvious time implications of this 'slow' method, a significant benefit is that it affords the researcher

contextual insight and physical presence to recognise and act on opportunities for collaboration as they arise. Thus, rather than imposing action or plans devised outside of the field on people, the researcher desiring to take participant observational research a step further and conduct collaborative, participatory action work in the field is able to respond to opportunities and incorporate participants into the process as co-creators. In addition to the participant observation, one-on-one and group semi-structured interviews as well as group meetings at various points in the research served to inform participants, gather insights, refine methods and strategies, and garner feedback on progress.

The fieldwork itself was conducted at times simultaneously, with interviews with fishers, for example, sometimes covering multiple topics, or with consecutive days focussing on different research questions. At other times, however, the work focussed on singular areas of enquiry for several weeks, such as during the development and deployment phases of the teaching modules. A total of two years were spent in the fieldsites, conducted over visits of between three and six months duration each, complemented by short follow-up trips following the conclusion of the core fieldwork.

Throughout the thesis, excerpts of interviews with research participants are presented. The majority of these were conducted in the local Afrikaans language and translated into English with all participants' identities made anonymous.

Research participants and field sites

Research participants

Throughout the course of this research, a wide range of people have participated in the work. With a focus on the linefishery, this meant working closely with 36 current and retired commercial fishers in the field sites, most of them skippers. The interest in working with skippers rather than crew members lies in the fact that they are the decision makers shaping the fishery's responses to change. In addition, fish processors, crew members, fish buying middlemen, fishery managers, entrepreneurs, linefish purchasing consumers, commercial charter fishers and others related to the linefishery were also interviewed.

Further to the linefishery participants, the work expanded into local communities, looking to school learners and teachers as co-creating partners in addressing challenges associated with social-ecological change and social learning. Members of the broader communities

were also consulted at various points in the research. In addition, outside experts including natural and social researchers, an engineer, an industrial designer, a marketing professional, a senior teacher, and an educational outreach specialist were also consulted in formulating and addressing responses to the challenges identified by research participants.

Title	**Total**
Commercial linefishers (active and retired)	Active: 24 retired: 12
Linefishery related participants	21
Linefish store customers	16
School learners	36
Teachers	9
Community members and parents of learners	27
Outside experts	6
Researchers	11
Total research participants	**162**

Table 1.1. Total research participants.

Field sites

Defining the scale and limits of a social-ecological system is challenging given the fluid nature of such systems' boundaries. The choice of study sites was informed by the research's role within the SCIFR project group, which incorporates research sites from Witsands in the West, to Mosselbaai in the East. Despite their considerably different geopolitical positioning from the region constituting the SCIFR project, the CUS and CURRA study areas displayed several notable similarities which render them important points of reference for the current work. These include contexts of rapid change, isolation, variable income scales, vulnerability, resource reliance and competition, and an intersection of smaller-scale and industrial enterprises. The research was place-based with the physical boundaries of the study area defined by Vermaaklikheid in the West, and Mosselbaai in the East with the towns of Stilbaai and Melkhoutfontein between them (Fig. 1.1). The spread of urbanisation and economic positioning in these towns provides a good representation of the varying levels of spatial and economic development along the southern Cape coastline, ranging, for example, from wealthy and urbanised in Mosselbaai to rural isolation with high levels of poverty in Vermaaklikheid.

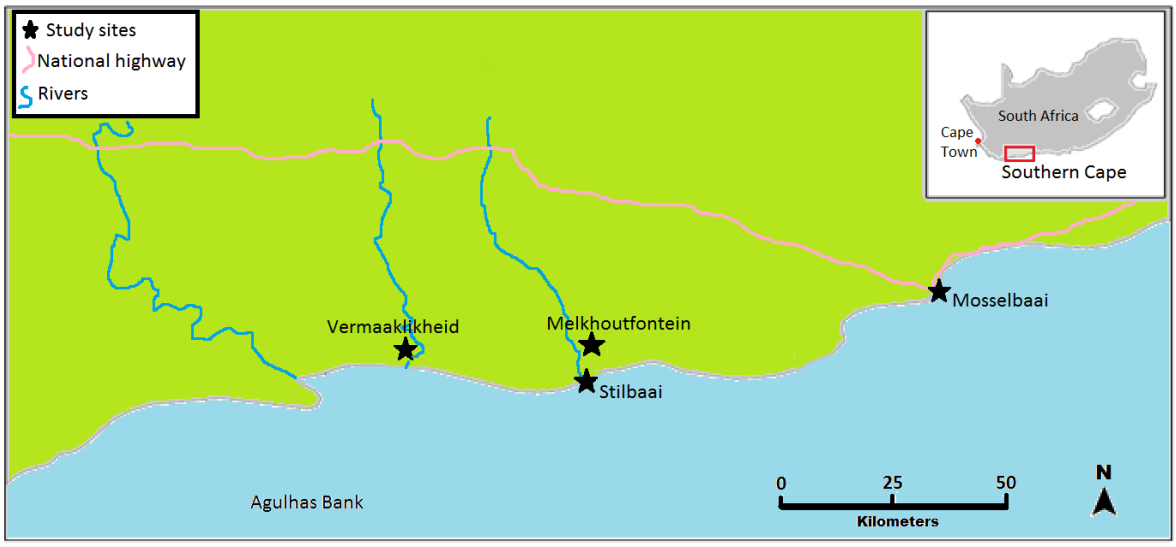

Fig. 1. 1 Map of southern Cape study sites (marked stars).

Today, the majority of linefishing effort in South Africa is concentrated on the Cape West and southern Cape coasts with the bulk of research concentrating on the West coast. This lesser focus on the southern Cape represents both a need and opportunity to work with communities in the region to address the questions raised by SCIFR. The southern Cape has a rich history as a centre of linefishing effort in South Africa, with sites such as Stilbaai, Melkhoutfontein, and Mosselbaai home to linefishing operations for over 100 years (Steyn 1996; Visser 2015). Whilst fishing represents just one of a suite of commercial enterprises in the region, it continues to represent a source of income and cheap protein for many poorer residents as well as being an important tourism draw card.

Vermaaklikheid

An isolated rural community approximately 40km along gravel roads from the nearest town, Vermaaklikheid represents the western-most extent of the study area. With severely limited infrastructure, at the time of the research it was home to some 40 families and a total population of around 200. With limited opportunities for agriculture or tourism, and located near the Duiwenhoks River, approximately 7km from the sea, Vermaaklikheid has a history of commercial fishing dating back to the 1960s when a local farmer began to operate three skiboats from the mouth of the river to supplement his income. With unemployment at 50%, and very low education levels (7.8% matriculation rate compared with the provincial average of 28.6%) (Lehohla 2012), Vermaaklikheid is a community trapped in a cycle of poverty in which subsistence fishing and occasional commercial linefishing trips, weather permitting, play an important role in supplementing income and food supply.

Stilbaai

Stilbaai developed as a holiday and later retirement town with a focus on fishing. Home to one of the oldest commercial handline fleets in the region (Steyn 1996), the town remains home to the largest number of registered skiboats and fishers. With a resident population of some 3500 people as per the 2011 South African government census (STATSSA 2017), Stilbaai is home to a large proportion of retirees as well as catering to seasonal holiday makers and tourists. As the traditional centre of the region's handline fishery, in 1995, it was home to 150 commercial linefishing skiboats (Steyn 1996) and today remains host to the largest fleet of commercial skiboats in the southern Cape. When the fieldwork began, there were upwards of 25 boats registered and operating out of Stilbaai, indicating the downturn that the linefishery has faced since the mid-1990s. Declining catches since 2010, however, have exacerbated challenges for local linefishers, with only 7 of the skiboats remaining active upon conclusion of the fieldwork in 2017. Despite commercial fishing having been long since usurped as the town's major employer, handline fishing remains an important part of the current economic activities by drawing holiday home owners and tourists to the harbour during holiday periods.

Melkhoutfontein

Located some 5km from Stilbaai, and with a population of approximately 2500 residents (STATSSA 2011a), Melkhoutfontein originated as a small subsistence farming and fishing community. Residents of the area had maintained Middle Stone-Age tidal fish traps, called 'visvywers' for multiple generations prior to the first commercial fishers from the town beginning to ply their trade on the nearby Goukou river in the late 1800s (Steyn 1996). Aside from manual labour, commercial fishing continues to represent one of the best employment options for the town's residents, supplementing both income and food supply, and most commercial handline skippers from Stilbaai rely on Melkhoutfontein to draw their crews. The Melkhoutfontein fishing community has been classified as "coping" with changes, faring somewhat better than the "reacting" community of Vermaaklikheid (Gammage et al. 2017), however, unemployment levels remain high and education levels low (STATSSA 2011b), at nearly half the provincial average (Lehohla 2012), with Melkhoutfontein representing a somewhat vulnerable town to fluctuations in the local economy.

Mosselbaai

Mosselbaai is a medium-sized commercial hub in the southern Cape with a population of nearly 100 000, and represents the eastern boundary of the study area. Home to a natural gas refinery and large commercial port, it hosts a fishing fleet ranging from ski- and deckboats to larger pelagic and demersal trawling vessels. Education and employment levels are high (STATSSA 2011b). As an early entrant into the commercial linefishery, alongside a small fleet of inshore trawlers, Mosselbaai linefishers have had to co-evolve and adapt in the face of competition from a well-organised and funded mechanised trawl since the earliest days of the Mosselbaai harbour (Visser 2015). In the face of this continuing resource competition from the inshore trawl fishery, Mosselbaai represents an important site in the research by providing insight into and examples of how fishers innovate and adapt to rapidly shifting forcing factors.

Thesis structure

Following this introductory chapter, each of the successive data chapters relates to one of the four central research questions posed above. Each of the chapters has been written as a stand-alone manuscript. As such, some of the basic context of the research is repeated in each.

Chapter Two relates to the question of measuring water temperatures and describes the process of involving fishers in a collaborative undertaking to co-design a novel water sampler device for measuring water temperatures at sea, on commercial skiboats. There is a lack of consensus in the scientific literature as to whether the inshore Agulhas Bank marine region off the southern Cape is warming or cooling (Blamey et al. 2015). Water temperatures provide important insight for researchers into the effects of climate variability and change, as well as directly impacting on commercial fisheries by influencing species present in an area, fish behaviour and sea conditions. Some water temperature data are available for the region, including inshore thermometer readings taken at harbours and slipways, a series of near shore underwater temperature recorder (UTR) moorings (Schlegel and Smit 2016), satellite derived sea surface temperature (SST) data, conductivity, temperature and depth (CTD) profiles from DAFF resource surveys, and ship-borne biannual temperature profiles along transects across the shelf. However, these means of measuring are not able to adequately capture regular data at depths such as those at which linefishers

operate. Water temperature has repercussions for fishers via its impact on fish behaviour. Linefishers have traditionally measured water temperatures with crude, inaccurate devices as a part of their daily fishing activities. Measuring water temperature thus represented an opportunity to open a conversation and potentially initiate collaboration between research scientists and fishers; two groups that have traditionally not had much success in working together in the South African context (Duggan 2012). Focussing on the collaborative process, the chapter offers insight into factors driving initial success, and continues with a discussion of the factors that ultimately undermined the process, suggesting that it is not enough to simply follow accepted participatory procedures in order to generate successful collaboration.

Chapter Three addresses the question of working with schools to address curriculum challenges and bring about social learning and describes a participatory action exercise working with teachers and school learners in two rural, underprivileged schools to co-develop of a series of integrated teaching modules for Grades 7-9. During preliminary fieldwork, students and teachers suggested that the national CAPS curriculum lacked contextually-relevant lessons or exercises. With few available resources to address this challenge, options were limited. In addition, the broader communities in which these schools are located also expressed a desire for improved access to information around pressing social-ecological challenges facing the local context. However, aside from lacking the resources to do so, these communities have long been marginalised by government, and remain mistrustful of outsiders. As such, simply bringing information to them or attempting to facilitate conventional social learning exercises would have been met with difficulty. In light of these challenges, the integrated teaching modules were designed with social and situated learning in mind as a means of augmenting the existing curriculum with locally-derived, practical examples. Further, the exercises as part of the modules encouraged students to interact with community members on pressing local issues such as fish stock decline and climate change as a means of initiating conversations beyond the classroom.

Chapter Four is concerned with the question of linefishers' organisations and associations in the southern Cape, specifically how and why some organisations fail where others flourish. In the wake of a failed Fishing Rights Allocation Process (FRAP) in late 2013, fishers in the region were given strong incentives to join officially recognised organisations. The Stilbaai

organisation failed, whilst neighbouring Mosselbaai's organisation thrived. Using a social capital lens, the chapter discusses the role of different forms of trust evidenced through the fieldwork, and the role of leadership in shaping successful responses to changing circumstances. In addition, the work explores the alternative means through which fishers in towns with failed organisations might create and associate themselves with the social capital necessary to facilitate their continued presence in the fishery and chosen lifestyle.

Chapter Five describes the process of creating a branding scheme for linefish as a means of addressing a longstanding relationship of dependence on fish buying middlemen who represent the interests of inshore trawling companies in the region and exert financial dominance over the buying and selling of linefish. Having identified with linefishers the qualities of linefish felt to best represent their brand, the chapter discusses initial pressure exerted by the middlemen before the branding could be deployed. This pressure led to the cancellation of the branding exercise in its initial form. A subsequent adaptation of the branding exercise is then presented in which one of the linefishers established a retail store initially supplied by his colleagues. Exploring the outcomes of this adaptation, the chapter identifies further challenges and benefits associated with the store including the continued influence of the middlemen.

Chapter Six concludes the thesis and provides a synthesis of the key findings, discussing the challenges and lessons learnt in the work with regard to the four core themes. In so doing, it evaluates the value of concepts of trust and social capital, situated social learning, resilience thinking and transformation, as well as the pitfalls and potential of participatory action research, situating each against relevant literature such as Armitage et al.'s (2017) *Governing the Coastal Commons* and significant projects such as CURRA and CUS.

Chapter Two: Challenges and lessons in collaboration: co-design and water temperature measuring in the southern Cape linefishery

Introduction

Systems perspectives in the research and management of situations where social and natural interests intersect have increasingly gained traction in the past two decades. Allied to this systems perspective in the realm of fisheries research, a considerable body of literature extols the virtues of integrative (Mackinson 2001; Williams and Bax 2001; Stead et al. 2006; Haggan et al. 2007), transdisciplinary (Stokols 2007; Ommer 2007; Starfield and Jarre 2011) participatory and collaborative research (Jentoft and Mccay 1995; Wilson 1999; Neis 2000; Stanley and Rice 2003; Wendt and Starr 2009; Mackinson et al. 2011).

Proponents suggest that working with local people in this way enriches the systems perspectives by providing a more holistic understanding of challenges, as well as providing insights from the local experience which scientific methods and perspectives might otherwise miss (Jentoft and Mccay 1995; Stanley and Rice 2003; Mackinson et al. 2011).

South Africa adopted an ecosystems approach to fisheries (EAF) management in the early 2000s (DEAT 2005). An EAF mandates, *inter alia*, that the Fisheries Management branch of the South African Department of Agriculture, Forestry and Fisheries (DAFF) work more closely with local fishers and fishing communities (Garcia and Cochrane 2005; DAFF 2012; DAFF 2015). Working with multiple groups and perspectives, however, is not often a straightforward process and one of the biggest challenges facing fisheries collaborations concerns the art of communicating effectively across different expert bodies and professional perspectives (Jacobsen et al. 2012). Several factors have previously been identified as enabling collaboration such as trust-building (Purdue 2001; Tansley et al. 2012) and leadership (Maak 2007; Gutiérrez et al. 2011). However, other factors such as financial and time constraints may serve to undermine participants' willingness or ability to collaborate (Brown-Luthango 2013).

In the context of the southern Cape's linefishery, characterised by a legacy of mistrust of those associated with government or research (Duggan 2012) born out of an ongoing marginalisation by government (Gammage 2015), integrating participatory methodologies is not as simple as rolling out a participatory policy or offering the option to stakeholders. In

light of these conditions, it is vital that researchers and policy makers understand the local context and engage in preliminary collaborative ventures which build trust and dialogue in order to develop appropriate participatory frameworks which are relevant and secure local buy-in. In short, what is needed is a carefully orchestrated progression towards fully integrated collaboration.

Water temperature is a primary influence on the biology and population dynamics of poikilotherm fish and shellfish, and hence on marine ecosystem dynamics. In South Africa, the Agulhas Bank plays a complex and nuanced role in a number of important fisheries, and the scientific debate as to whether its inshore area is warming or cooling continues (Blamey et al. 2015). Time series of water temperature observations are available for the Agulhas Bank subsystem of the southern Benguela captured either *in situ* using handheld thermometers or tethered underwater temperature recorders (UTRs) (Schlegel and Smit 2016), from conductivity, temperature and pressure (CTD) profiles from resource surveys conducted by DAFF, or via satellite sea surface temperature (SST) readings (Smit et al. 2013). However, none of these data sets pertain to the bay scale at which the southern Cape linefishery operates. Furthermore, it has been found that current SST temperature measurements display up to a $+6^0$C bias over *in situ* measurements for the same areas, suggesting a risk in applying offshore SST data to inshore applications (Smit et al. 2013). Where *in situ* handheld thermometer readings are concerned, these are collected at the surface and in shallow water, for example inside harbours. As such, an accurate representation of water temperatures in the inshore fishing grounds, particularly at fishing depths, is lacking and difficult to collect. UTRs go some way towards ameliorating these issues, but being stationary and set at shallow depths, are unable to provide an accurate spread of temperatures at different depths or, again on the actual inshore fishing grounds. UTRs are also expensive to purchase, deploy, and maintain, and currently limited in distribution.

As much as water temperatures on the Agulhas bank are important for marine scientists, measuring and recording long-term water temperature data is also important for linefishers, with water temperatures influencing the behaviour and feeding patterns of target fish species (Duggan et al. 2014). As such, linefishers routinely observe and record water temperatures on their fishing trips, as well as making notes concerning anomalous

temperature events (Duggan 2012). Southern Cape linefishers make use of a range of water temperature measuring devices from handheld swimming pool thermometers to electronic sensors attached to their vessels' hulls. Further to this, linefishers in the region have previously voiced an interest in collaborating with researchers to measure water temperatures (Duggan 2012).

The overlapping interests of scientific and fishing groups in water temperature data in the Agulhas region represented a moment of convergence. Such moments of convergence are important in the contemporary South African fisheries context where collaboration meaningful for all parties has been slow in developing. Using the shared interest in water temperatures, and acknowledging the legacy of mistrust, the objectives of this research were to facilitate the co-development of a device to measure water temperatures accurately from commercial skiboats, engaging linefishers as collaborators in collecting water temperature data, and to using these data to open conversations between fishers and marine researchers around topics relating to marine water temperatures such as their impact on fishing.

The starting point was to be the co-development of a device to accurately measure water temperatures from linefishing vessels in the southern Cape region. To this end, the work drew from participatory action research and co-development, and the related concept of lead users (Morrison et al. 2004; Jeppesen and Laursen 2009; Ozer 2009). Core precepts of the participatory action approach include deep participation by all collaborators, co-learning between researcher(s) and members of the group, the incorporation of local knowledge into the process, an interdisciplinary perspectives drawing from a range of appropriate methods, theories and approaches, a case-specific orientation with a focus on improving the participatory process, and lastly, the forging of explicit linkages between social observations and meaningful action (Greenwood et al. 1993).

By involving a range of participants and perspectives, it was hoped that both the marine water temperature measuring device and water temperature data would serve as boundary objects (Star and Griesemer 1989; Star 2010) in fostering conversations between researchers and fishers with a view to initiating conversations around water temperature and related topics. The notion of a boundary object suggests an object or concept which is

“plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites” (Star and Griesemer 1989: 393). A common example of a boundary object is a map – for some users the map might represent a place of recreational for hiking purposes whilst for another group, it might indicate sites of ecological importance (Star 2010). The map in this instance is thus the boundary object which different users perceive and use differently in other words, acting as “a sort of arrangement that allows different groups to work together without consensus” (Star 2010: 602). Boundary objects may thus act as both organising force and facilitator of collaboration without the need for various engaged parties to modify or compromise their knowledge position, a noted challenge in collaborative, multi-perspectival ventures (Calheiros et al. 2000; Verran 2002; Stanley and Rice 2003). In this way, it was intended that the water temperature measuring device would facilitate a conversation and collaboration around water temperatures without the need for researchers or fishers to compromise their knowledge positions or risk undermining each other’s understanding of the importance of water temperatures.

The objectives of this chapter are twofold. Firstly, it seeks to provide insight into the factors that drove an initially successful collaborative process to co-develop a device to accurately measure marine water temperatures from linefishing boats. Secondly, the chapter details factors that challenged the collaboration and ultimately led to its breakdown.

Methodology

Field sites

Fieldwork was conducted with commercial traditional linefish skippers (hereafter referred to as ‘fishers’ or ‘linefishers’) in the southern Cape coastal region of South Africa in two towns; Stilbaai and Mosselbaai. The towns were selected for several reasons including population size, relative importance of the fishery, and economic structure. Mosselbaai stands as an economic hub in the region with a population of nearly 100 000 (STATSSA 2011b) and home to a large commercial fishing harbour with a long history of commercial linefishing and inshore trawling (Visser 2015). Stilbaai by comparison has a population of 3500 inhabitants (STATSSA 2017) and developed as a somewhat geographically isolated retirement and seasonal holiday town (Steyn 1996). Despite being the smaller town and having a far smaller harbour, Stilbaai remains home to the region’s largest concentration of linefishing boats.

Boats

Fishers from both towns have, since the early 2000s targeted their efforts towards catching Silver Kabeljou (known locally as 'Kob') (*Argyrosomus inodorus)*. However, steadily declining Kob catches since 2010 have forced the fishers to begin targeting alternative species, a switch which has been strongly influenced by the towns' harbours and as well as the types of boats the linefishers operate. In turn, these declining catches, switch in target species and vessels have all impacted upon the collaborative process of measuring water temperatures.

Two types of boats operate under linefish licences, skiboats and deckboats. Both deckboats and skiboats are restricted by law to a maximum length of ten metres. Skiboats are powered by twin outboard engines, are constructed of wood and fibreglass, and are of an open type construction, the deck separated into open holds in which the catch is stored. Given their limited space, skiboats are able to hold up to 2 tonnes of fish. Deckboats are constructed of the same mix of materials and powered by a single inboard diesel engine. However, they have a far larger girth and draft than skiboats and, as such, are able to hold larger catches of up to 5 tonnes. Skiboat trips seldom last longer than 18 hours in duration and range in distance from 5km to as much as 60km offshore but generally the vessels remain within 30km of the shore. Due to their size and manoeuvrability, skiboat trips are more dynamic with skippers often opting to search for shoals rather than wait on one location. Deckboats, owing to their size and capacity, travel as much as 150km from port and remain over the fishing grounds for up to a week at a time. Being slower and less manoeuvrable, their skippers are also less likely to search as widely for fish as their skiboat counterparts. Mosselbaai's harbour is significantly larger that Stilbaai's, enabling linefishers to readily switch to deckboats in recent years, with Stilbaai's skippers forced by their small harbour to continue operating skiboats.

Approach

Ethnographic participant observation methodology formed the basis of the fieldwork. This involved a combination of both observations at sea and on land. In addition to the observations, 22 individual and three semi-structured group interviews were conducted with participants in both towns. Eighteen individual and six group meetings were also held with fishers at different stages of the co-development process to plan and execute the design and garner feedback. Respondents were chosen for their regular participation in the

linefishery as skippers and/or vessel owners and an initial interest in participating in a collaborative process. All participants' names have been changed for purposes of anonymity. The ethnographic interviews below have been translated from Afrikaans into English.

A principle condition for success in collaborative research is the inclusion of local research participants from the outset (Brown-Luthango 2013). To this end, the approach was informed by participatory action research with a view towards involving research participants as co-creating contributors in the process from the outset in addressing the question of how to more accurately measure marine water temperatures on the linefishing vessels.

Related to participatory action research, and tied to the need to include research participants from the outset, is the importance of understanding their needs (Brown-Luthango 2013), and incorporating these into the research design to render the process more accessible, meaningful, and appropriate to context. The this end, the research made use of a co-development approach, also described as the lead user approach (Morrison et al. 2004; Jeppesen and Laursen 2009; Ozer 2009). This approach was selected by virtue of its relevance to collaborative research, positioning participants as actively engage contributors and thus representing a technique by which to address fishers' longstanding sense of marginalisation by involving them early and deeply in research formulation and securing their buy-in. Lead users are those in the target market who actively require a product and who will directly benefit from it (Lettl et al. 2006), being thus compelled or incentivised by their position at the forefront of the market to innovate in order to gain a competitive advantage over their peers (Harhoff et al. 2003; Morrison et al. 2004). In this way, lead users who contribute towards solutions or innovations that benefit their position are considered more likely to understand problems accurately and thus design products which will be successfully adopted by end users (van Kleef van Trijp and Luning 2005). Within this paradigm, envisioned end users of a product are incorporated into the planning, design, and development phases of the product (Ozer 2009). Critically, lead users offer insights which may inform the product development process such as the finished product is more likely to be fit for purpose and thus readily adopted in the market (Ozer 2009), marking this as a powerful complimentary approach in conducting participatory action research.

An additional benefit of incorporating lead users into the participatory action research approach is their role in the diffusion of the product to other users via their position as market leaders (Morrison et al. 2004). In this way, it was envisaged that those researchers and linefishers who expressed interest in collaborating in the design of a water temperature measuring device would act as lead users by virtue of their position at the leading edge of their industries, contributing their knowledge to the development of a product which would suit their needs, and spreading it to their peers via their positioning in their respective fields.

Results and discussion

The results of the collaborative exercise are presented below in three sections, covering the three phases of the research. Within each phase, several factors were identified as either driving or constraining the process of collaboration (Table. 2.1). Having observed fishers' and researchers' shared interest in marine water temperatures and identified fishers who would act as lead users of the finalised device, the first phase focussed on the co-design of a device to measure water temperatures at sea. In this phase, various designs were co-developed and tested building on fishers' existing technology, outside experts were consulted, and a finalised prototype device was agreed upon and placed on four commercial skiboats. During this phase, the first of several interrelated trust issues arose. In the testing and deployment phase, one of the fishers emerged as a champion of the project, adapting the device to suite his fishing style, collecting and regularly submitting data. At this time, however, further issues of trust emerged, particularly an unwillingness of the fishers to share GPS coordinates, even in reduced resolution. Lastly, the third phase is presented as the breakdown of the collaborative process, highlighting the influence of declining catches combined with a split in focus amongst the fishers on either profits, or the maintenance of a lifestyle of semi-retirement, to both of which collaboration represented an unnecessary effort. Further, despite their initial interest in the project, as water temperature data represented a historical dataset and not a forecast, Mosselbaai fishers suggested in follow-up interviews that such measurements were of little interest.

Phase	Drivers	Constraints
Co-design phase	• fishers act as lead users • co-development and testing of prototypes based on fishers' existing technology and designs • consultation of outside experts	• issues of trust arise around researchers on skiboat
Tesing & deployment phase	• lone fisher champions the project, adapts device to suite his fishing style	• further issues of trust around unwillingness to share GPS coordinates
Breakdown phase	• importance of continual researcher presence	• influence of declining catches • fishers' split focus on either profits or semi-retirement lifestyle • measurements seen as of little interest

Table 2.1 Overview of research phases with associated drivers and constraints in the collaborative process.

Co-design phase

Measuring water temperature is an important aspect of linefishing, particularly where Kob fishing is concerned. In a 2013 conversation in Mosselbaai with collaborator Paul, the fisher suggested:

> *I've always checked the (water) temperature – we send (a thermometer) down with a little lead weight on and check what's (happening) at the bottom …ja, it's one thing to know what the temp is at the surface…but you want to know what that (fish) is swimming in so you know if he'll be there and if he is, you'll know there's a good chance he'll be behaving the same at the same temperature somewhere else if you find it again…our fish (the Silver Kob) bite at a specific temperature range – 14, 15 to 22 degrees is optimum, so we look for that.* (Paul)

The most common thermometers used in the linefishery are generic swimming pool thermometers. Initially wishing to work with fishers' existing methods and technologies, several swimming pool thermometers were purchased. These were tested against a calibrated laboratory thermometer as a control. From this testing it was apparent that the

swimming pool thermometers were highly inaccurate, misreading by as much as 6^0c when compared with the calibrated laboratory thermometer in water temperatures below 0^0c.

In early 2013 discussing this issue with several Stilbaai fishers, fisher Jeff suggested that the laboratory thermometer could be safely housed inside a section of copper tube which acted as a casing, cushioning it from blows inflicted by boat hull or reef. Jeff had used such a device for years and explained that it clipped straight onto the fishing line, could be lowered to the bottom, quickly raised and a reading taken. Having replicated Jeff's design, a plan was made with Mosselbaai fisher Paul to test the device from his skiboat. This would be done by comparing the readings with those of a calibrated conductivity, temperature and depth (CTD) device. The comparison was to be conducted by a senior marine scientist however, upon arrival in Mosselbaai, the fisher became hesitant about the trip, postponing it several times over the course of the day and eventually cancelling his offer, suggesting rather that it might be best to meet on land to discuss water temperatures. This result was the first of a series of challenges around the mistrust by which fishers regard researchers.

Following this initial hurdle, the copper tube casing was tested by the marine scientist against the CTD from a private recreational boat in Cape Town. This testing found the laboratory thermometer to be of reasonable precision (reading within 0.5^0C of the CTD at the surface) but the thermal conductivity of the copper meant that the unit did not capture temperature at depth but rather reflected that of the upper layer of the water column as it was drawn up. Furthermore, holding the device conducted body heat, further skewing the reading. A further evolution of the design saw a small PVC tube replacing the copper one to mitigate against thermal conductivity (Fig. 2.2) but further testing indicated that this still allowed the thermometer reading to change as it was drawn up through the water column.

Via a series of group meetings and individual interviews with Mosselbaai and Stilbaai fishers, as well as an oceanographer-fisher, it was suggested that the laboratory thermometer remain housed in its PVC tube but that this be encased in a larger PVC pipe to protect it and act as a thermal barrier. In consultation with an industrial designer, a simple silicone gasket closure mechanism was developed to fit inside the outer pipe at either end (Fig. 2.2), allowing the device to trap ca. 5 litres of seawater at the desired depth. In this final iteration of the design, the laboratory thermometer, secured in its inner casing is clipped to the inside of the larger outer cylinder. Once the device reaches the desired depth, an upwards jerk

closes the silicone gaskets and a continuous upwards pull secures the water for its trip to the surface. The insulating effect of the PVC outer and inner pipes allow the fisher time to access the thermometer within a roughly one minute window period without changing the water temperature inside the tube.

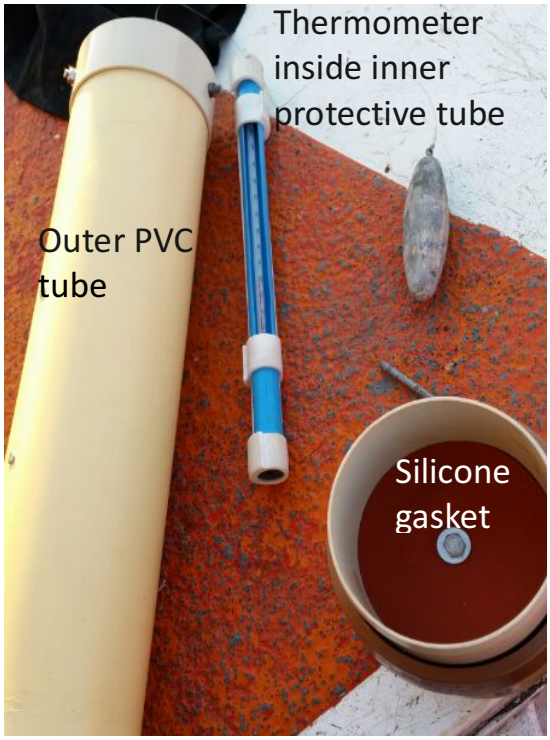

Fig. 2.2. Finalised water temperature sampler device showing the outer protective and insulating PVC pipe, inner thermometer tube, and top silicone gasket.

A total of four prototypes were manufactured with the help of fishers in Stilbaai and Mosselbaai and placed in the hands of those fishers who displayed the most interest in the project. In addition, the fishers were consulted as to what data they would be comfortable providing and the means through which they preferred to submit it. It was agreed at this point that data would be submitted on a monthly basis and the fishers were provided with a printed log sheet containing agreed upon fields including date, GPS coordinates (though omitting the last digits of the reading in order to not compromise the exact location of the fishing spot), top and bottom temperatures, bottom depth, and a space to note conditions and observations on the day.

Testing and deployment phase

Although four fishers received samplers initially, one Mosselbaai fisher in particular, Paul was quick to adopt the device and adapt it to suit his fishing practise. This phase of the research resulted in nearly 18 months' worth of collection of temperature measurements by Paul yet the fisher continually omitted GPS points, preferring to submit the names of nearby reefs or landmarks. In this time, despite the presence of additional devices on vessels, no other data were recorded or submitted by the other fishers. The initial successful deployment of the water temperature sampler on Paul's boat was determined in large part by Paul's eagerness to engage in research, as well as his adaptation of the device's potential to benefit his fishing. Previously Paul had, like most of his colleagues, used an uncalibrated swimming pool thermometer to measure temperature at depth. As such, Paul described a scenario related to the inaccuracy of the swimming pool thermometers. Arriving at a reef, the echo-sounder would indicate a shoal of Kob. Lines would be cast out, but the fish would not take the bait. It was common practise at such times for the skipper to lower his swimming pool thermometer to the depth the fish were swimming at. Anecdotal observations from linefishers indicate that Kob tend to slow or cease their feeding in water temperatures below 14^0C (Duggan 2012 and see ethnography above). The inaccurate swimming pool thermometers, often reading higher than the actual water temperature, might indicate that the bottom temperature was within the feeding range of the fish and the fishers would thus keep trying.

With the calibrated measuring device on-board, however, the situation quickly changed for Paul and his crew. Facing the same scenario described above soon after receiving his water temperature sampler, the fisher lowered the device along with his swimming pool thermometer to the fishing depth. Retrieving both, he noted that despite the swimming pool thermometer's higher reading, temperatures at the fishing depth were, according to the accurate laboratory thermometer in the sampler, too low for Kob to feed. In this way, Paul utilised the device to his own ends as a means of accurately evaluating the feeding state and potential of Kob thus saving himself time over the fishing grounds.

While Paul's personal interest in research and willingness to record and submit water temperature data were important drivers of the collaboration by early 2015, during this initial testing phase, a challenge to the collaborative process became apparent. With Kob

catches on the decline since 2010, the location of reefs and undersea pinnacles were closely guarded, and fishers were uncomfortable sharing their locations with those outside the fishery. Paul's log sheets submitted as part of the temperature data collection process reflected this, providing place names for reefs or landmarks as a very general reference rather than the truncated GPS coordinates that had been agreed upon during the late co-development phase. In early 2016 Paul departed the linefishery and with his departure, data collection ceased.

Following Paul's departure, the focus of the research shifted onto working with other Mosselbaai and Stilbaai fishers. Paul's previous reticence in sharing GPS coordinates suggested that other fishers might also be uncomfortable with sharing such information. From early 2017 the research thus entered a new collaborative phase, working with the marine scientist responsible for the establishment and maintenance of the South African Coastal Temperature Network (SACTN) (http://robert-schlegel.shinyapps.io/SACTN/), a publicly available online marine water temperature database. The SACTN database collates inshore water temperature data from 129 *in situ* sources, mostly collected using handheld thermometers and UTRs and supplied by seven organisations and South African government departments (Schlegel and Smit 2016). Importantly, the grid used in this database still provides a platform for fishers to contribute GPS coordinates at a scale than does not compromise their trade secrets. This was communicated to fishers in Mosselbaai and Stilbaai in early 2017 as part of follow-up fieldwork. In this way, the opportunity to work with SACTN represented the prospect of re-establishing collaboration by circumvent the fishers' reluctance to share spatial information.

Breakdown phase

Since 2010, Kob catches in the region have been on the decline (Winker et al. 2014), and increasingly the fishers were faced with a dilemma. As the most valuable species in the linefishery, and one caught in substantial amounts by inshore trawlers in the region (Winker et al. 2014) this decline has had profound impacts on the linefishery. In Mosselbaai, the linefishers switched to the larger deckboats enabled them to shift focus from Kob to targeting Silvers (also known as Carpenter) (*Argyrozona argyrozona*), located on reefs up to 130km from the harbour. In Stilbaai, however, the size of the harbour was not conducive to operating deckboats and the fishers were forced to retain their skiboats, placing them in a

difficult position. With most Stilbaai skiboats unable to safely access the more distant reefs to fish for Silvers, and in view of the poor availability of Kob, most were forced to target a shrinking basket of species including sharks and strictly reef-associated redfish. The effect of these changes on the fishers in both towns was profound. In Mosselbaai, pressure arose in the form of additional costs of operating deckboats, the risks of travelling so far to sea, and the lower prices obtained for Silvers in comparison to Kob. In Stilbaai, the declining catches compounded the financial cost of having to search more widely to find fish.

Field observations at this time indicated that the issues of trust around sharing specific GPS coordinates with researchers could be resolved via the use of the SACTN database. In a mid-2017 interview with Mosselbaai fisher Robert, for example, the skipper suggested that the scale of GPS marks required by the database would not raise his and his colleagues' previous discomfort in providing specific marks:

> *Ja no fine, this, we can work with. I have no problem with that (scale) – you can't find that specific reef with (those) coordinates I can say so…it's not giving it away…no, I don't have a problem sharing that with you people.* (Robert)

Despite resolving the issue of project-specific agreements on the precision of spatial information via the SACTN database, the fishers continued to stall in supplying measurements from the device. In the increasingly variable fishery, the fishers' responded by shifting their foci. In Stilbaai, the fishers, unable to make the switch to deckboats were forced to either travel large distances to sea in order to target Silvers, or to target the shrinking basket of species closer to shore. This position placed considerable time-pressure on the fishers, limiting their ability and willingness to perform additional tasks such as deploying the sampler or filling out the form, compounded by a focus on a semi-retirement lifestyle (see Chapter Four).

Where their counterparts were limited by time, when the Mosselbaai fishers switched to deckboats and the targeting of Silvers, the necessity of quickly determining an accurate bottom temperature diminished. Despite spending considerably longer periods of time at sea than their skiboat-operating neighbours, in a mid-2017 meeting to discuss the prospect of deploying the water temperature device on his two boats, fisher Robert forthrightly suggested a reason for his colleagues'' reluctance to collect data using the device:

> *No. We won't use it. I can tell you. It won't work, not for me or my guys at least. I can tell you why - when we are out at sea, we are fishing. End of story. A man doesn't want to spend time with that (sampler) – you are there to fish…we measure the temperature though. We use a thermometer on the surface and the bottom depth we measure it our way… the temperature inside the fish itself.* (Robert)

This sentiment echoed an earlier interview in mid-2016 with Stilbaai fisher Philip in which the fisher explained that his interest in collaborative experimentation fluctuated in line with the fortunes of the fishery:

> *…when the fishing is good and we have time for that sort of playing around. But listen, now, it's hard for me to think about this stuff, you see? We must find work elsewhere, and we must focus on keeping our house and feeding ourselves. That kind of experimenting (we) do all the time, but we keep it for when it's time, when we have plenty fish and you know you can take a half hour and throw in a line and experiment and not worry that "oops, you've lost this fish" and so on and so on, you know.* (Philip)

In Mosselbaai, the focus of the linefishers could best be described as centred on profits. Follow-up fieldwork suggested, in line with the findings of Gammage et al. (2017) that these fishers prioritised economic gains over other concerns (also see Chapter Four). Discussing his reticence around using the water temperature sampler on his deckboat, for example, Joe explained:

> *Ja, look, for me and all these guys, you see – we are here to fish. That's it. The experimenting we do is so we can catch more fish faster. That's it. We can help (you) as much as we can, but I'm telling you now, a guy's not going to go out of his way to throw that (device) overboard if it's going to cost him time – and time is money my friend.* (Joe)

In Stilbaai, linefishing represented a means of supplementing income without necessitating that fishers work a regular work-week. In this scenario, the emphasis of fishing was on catching sufficient numbers to sustain a lifestyle of semi-retirement, supplemented at times by additional enterprises such as mechanical repairs to recreational boats, for example. The additional time and effort required to deploy the device and fill in a data sheet proved to be

an extra effort which, when put to the test, did not correspond to this outlook. As catches declined further, and the risks, costs, and work required to catch fish increased, this challenge only became larger. Following Jeff:

> *...the problem is we don't really go out that much anymore, you see…and if we do, it's quick-quick - see what we can catch to make some petrol money and buy a steak (laughs). I think the problem you have here is the guys are lazy – we've all come (to Stilbaai) to relax – so if it's not something a guy* has *to do on his boat, he's not going to do it…* (Jeff)

Following the culmination of the core fieldwork in early 2017, and Paul's departure from the fishery soon thereafter, no further data were collected. In a late 2017 bid to re-establish the conversation and collaboration around water temperatures, a fieldtrip was undertaken to introduce the marine scientist and curator of the SACTN database to fishers in Mosselbaai and Stilbaai. The need to return to the field in order to re-establish the process and motivate participants here suggests the importance of a continual research presence to drive and sustain collaboration. Further, despite several follow-up trips and regular phone calls to participants, in the absence of a constant presence, the interest of participants was not sustained. During this trip a further reason for this lack of interest was elucidated upon during a meeting with the chairman of the Mosselbaai linefishers' organisation, Robert. In this meeting, the fisher reaffirmed a commitment by himself and his organisation's members to collect water temperature data but only if they were able to do so by measuring the internal temperature of fish. However, during the meeting, the fisher also explained that given the shift in focus to Silvers, the water temperature measurements were of little use to himself or his fellow fishers:

> *Yes, it's interesting, but you see, this is no really useful to me – this is, I can say, a history. It helps you know what was going on at a certain time. But what we are interested in is a forecast – so this cannot help us.* (Robert)

Where the fishers had previously focussed on Kob over the inshore reefs, its sensitivity to water temperatures had made the device valuable to fishers like Paul. However, with the shift in focus to Silvers, caught at considerably greater distances from shore, the device lost its' appeal; using the slow deckboats to reach these fishing grounds, the need for

forecasting, rather than real-time data that could contribute to a historical time series, had now become a priority. Here the difficulty in convincing the fishers to utilise the device was compounded by the historically high variability in the system social-ecology of the region (see Chapters Four and Five). Combined with the two regime shifts observed in the region in recent years (Blamey et al. 2012; Blamey et al. 2015; Ward in prep.) the fishers have taken to focussing on short-term strategies (Gammage 2015) and as such, planning beyond 5-7 years is affected by too high a degree of uncertainty to represent a viable strategy in their experience.

Overall Discussion

Several key factors served to motivate the collaborative process of developing the water temperature measuring device. The shared interest in measuring marine water temperatures held by fishers and researchers represented both a challenge and an opportunity in reconciling different knowledge positions. Described as a dilemma in collaborative fisheries research (Jacobsen et al. 2012) the question of how to effectively communicate concepts between these different knowledge positions is a difficult one to answer. To this end, the water temperature sampler and water temperature data were intended to serve as boundary objects (Star and Griesemer 1989) which might facilitate conversations between fishers and scientists without either party having to agree precisely on, or compromise their own view on the value, role, or meaning of water temperatures.

Further, it was intended that the participatory and collaborative process would secure the buy-in of participants through their personal connection, as lead users, and the resultant applicability of the finished product within their livelihood (Morrison et al. 2004; Ozer 2009). The co-development and lead user approaches thus contributed to the initial success of the project by involving fishers from the outset (Harhoff et al. 2003), enabling them to not only understand the goals of the research but to actively contribute to them and the design of the device, as well as the methods of data collection (Jeppesen and Laursen 2009). Importantly, the use of the co-development and lead user approaches also encouraged the participants to build on their own existing technologies, enabling the adoption of local innovations such as the inner protective sleeve, for example. Here again, Paul's rapid adoption of the device to suit his needs evidenced how this approach rendered the finished design a ready fit within the fishers' routine, at least during the time when Kob was still the

primary target species. The use of outside experts to overcome certain design difficulties is also notable in driving the process forward where it might otherwise have become stuck.

The success of the initial co-development phase of the research, as well as the sampler's deployment on Paul's vessel and his submission of data also speak to the importance of a local champion to drive the process along. Tied to this was the importance of regular contact between researcher and participants. In their evaluation of participatory action research methodology, Greenwood, Whyte and Harkavy (1993) suggest that the researcher's ability to establish and sustain the process is a principle driver in the participatory action process. In the initial co-design phase of the research, the long-term ethnographic fieldwork spoke to this suggestion by building rapport and trusting relationships between the researcher and the fishers.

A presence in the field during these stages enabled face-to-face contact with participants on a consistent basis, acting to motivate involvement and provide a degree of guidance when problems arose. This presence also acts as a constant reminder to participants that they are collaborators, thereby sustaining support. The role of the researcher in this role was evident following the conclusion of fieldwork, at which time the project began to falter. This result, however, also suggests that without a constant presence in the field continuously motivating participants through direct contact, the demands of everyday life coupled with the pressure of a fishery under change and issues of self-interest are enough to hamper further collaboration. Recent South African research into collaboration between university researchers and local communities suggests that trust and relationship building are of value to the collaborative process (Brown-Luthango 2013). Indeed, it has been suggested that initial and sustained trust-building between participants is a quintessential ingredient in successful collaboration (Ostrander 2004). Paul's willingness to collaborate by collecting and submitting water temperature data, but unwillingness to take a further step in allowing a marine scientist onto his vessel to conduct research, for example, speaks to the intertwined dynamics of power and trust which continue to dog the South African inshore fisheries.

It has been noted that one of the significant dilemmas facing participatory and collaborative fisheries science is that fishers often assume that scientific research is linked to management agendas, with the assumption on the part of fishers being that scientists have influence beyond their official capacity in aspects such as enforcement and regulation

(Jacobsen et al. 2012). Furthermore, the dominant perception of science as an authoritative institution and its links to management agendas presents a challenge to researchers wishing to conduct collaborative research in a more symmetrical relationship to fishers (Jacobsen et al. 2012). In South Africa, the legacy of marginalisation and mistrust that persist in the inshore fisheries (Jarre et al. 2013; Gammage 2015) exacerbate this situation. Although there is some communication between inshore traditional fishers, government, and scientific working groups, this is by no means widespread. This mistrust of government is important in the current work, as government trust may have influential effects on people's willingness to engage in aspects of life they consider to be linked to government (Scrivens and Smith 2013). Paul's unwillingness to invite the marine scientist onto his vessel to conduct the initial prototype tests, or his colleagues' willingness to repeatedly engage with researchers and verbally commit but not supply data spoke to these points. Wishing to keep an eye on developments by remaining engaged, the fishers' openness to collaboration was constrained by their wariness of researchers perceived links to government.

In a context of declining catches and rising costs, and the need for improved political representation in the wake of the 2013 FRAP court case, the potential economic and political advantage should act as a strong motivator. In this regard, collaboration and trust building have been linked to economic prosperity (Scrivens and Smith 2013) such that improved trust and collaboration between individuals and groups may manifest in economic payoffs for participants (Knack and Keefer 1997; Putnam 2001). Likewise, the accumulation of social capital in the form of trusting collaborative relationships may have additional benefits for political representation (Putnam 2001), for example where joining an organisation or linking with those in positions of power may improve members' ability to have their interests represented. It might be reasonably expected then, that fishers would feel compelled to collaborate with researchers through the possibility of securing access to relationships and linkages which in turn might provide fishers with access to networks beneficial to their political and economic position. Yet in the case of the temperature measuring exercise, this was not so. One possible reason for this might be the fishers' existing links to researchers and DAFF. In Mosselbaai, for example, the leadership's personal connections with a DAFF representative may be deemed sufficient by the fishers to secure access to information without the need to collaborate further.

Various forms of trust have been described (see Purdue 2001; Newton and Zmerli 2011; Tansley et al. 2012). In the case of the fieldwork, however, Paul's decision not to allow the marine scientist onto his boat with a CTD displayed what might be termed "political mistrust". Where political trust refers to an indirect form of trust in a person or group accumulated without the need for personal contact (Newton 2001) – as when an individual votes for a political party – in this instance, Paul's mistrust was accumulated in the same way. As such, despite a commitment to collecting and providing data, and having never met the marine scientist, the fisher was unable to reconcile his political mistrust of natural sciences in general to the point of hosting a natural scientist on his vessel to calibrate thermometer readings. This result suggests that trust has a bearing on the fishers' willingness to collaborate, which at first appears at odds with Newton's (2001) suggestion that the existence of goodwill or political trust is not necessarily linked to people's willingness to volunteer.

However, after removing the need to accommodate a marine scientist on the boat and introducing the SACTN database to the project as a means of overcoming the fishers' concerns around supplying precise GPS coordinates, Newton's (2001) argument holds: the removal of barriers to trust still did not necessarily mean that they would be motivated to volunteer of their time or resources in pursuing full collaboration. Following Paul's departure from the fishery, for example, no further data were received from the participants. Whilst notions of trust certainly underscore some of the earlier collaborative challenges, this turn of events suggests the role of further drivers in hampering collaboration.

The work of Stanley and Rice (2003) and others (Williams and Bax 2001; Stead et al. 2006; Haggan et al. 2007) suggests that the integration of fishers into the research process as full collaborators strengthens trust and fosters dialogue. Discussing the outcomes of a university-community collaboration, Brown-Luthango's (2013) work on the Philippi area of Cape Town suggests several prerequisite criteria crucial to the collaborative process. These include the forging of relationships between researchers and community participants; a clear delineation of the research goals and the steps of the process; as well as the full involvement of participants along each stage of the process. The structure of the co-development exercise, and the use of ethnographic participant observation methodology in

the present work serve to address these criteria. Yet in the case of the water temperature data collaboration, full integration, trust-building, and co-development proved insufficient motivators. In their work on participatory fisheries science dilemmas, Jacobsen et al. (2012) suggest that the work demands of fishers' livelihood, and the needs of researchers are often difficult to reconcile. With fishers often operating under challenging conditions and limited timeframes, conducting additional work in the form of research places additional strain on them (Jacobsen et al. 2012).

This result begs the question of why the exercise was initially successful on Paul's skiboat. Two factors may have been responsible for this initial success. Firstly, the fisher was inherently interested in scientific research and, as a lead user, was motivated to innovate his fishing practises to gain a competitive advantage. To this end, the sampler had proven useful by allowing him to more accurately assess the bottom temperature when targeting Kob, thereby improve efficiency and providing a competitive advantage over his peers in the face of declining catches. Secondly, Paul's focus on Kob, sensitive as they are to temperature fluctuations, and use of a skiboat conducting quick trips over inshore reefs meant that real-time water temperatures played a greater role in his fishing. By comparison, his colleagues, switching to deckboats in order to target Silvers at significantly greater distances from shore, over longer periods quickly came to rely more heavily on forecasting than real-time or historical data. With the device having been co-developed at a time when the fishery still focussed its sights on Kob, the shift in target species in this way contributed towards the deckboat skippers' unwillingness to collaborate. Furthermore, the fishers' focus on short-term strategies to deal with the high variability and unpredictability in the region reinforced this lack of interest in recording data which would provide insight into medium- to long-term variability and change.

Compounding this lack of interest in tracking variability is an economic focus which dominates the Mosselbaai fishers' activities. This desire to maximise profits above all else thus represents a driver operating counter to collaboration. Here the "time, effort and investment" (Brown-Luthango 2013: 309) required of fishers to sustain the collaboration proved incompatible with their economic focus, representing an impediment which superseded their interest in collaborating. In Stilbaai, the water temperature sampler was also not readily adopted. Here the barriers of time investment and required effort were

incompatible with the fishers' focus on a semi-retirement lifestyle, echoing Brown-Luthango's (2013) suggestion that despite fulfilling the accepted criteria for collaborative research, collaborative research projects cannot naively ignore factors such as the time requirements and personal investment of effort of participants which directly impact upon the establishment, maintenance and long-term success of such undertakings. In certain circumstances such as those that face the southern Cape linefishery, this prioritisation of particular pursuits undermines the points of connection between researchers and fishers, effectively limiting the latter's interest in sustaining full, meaningful collaboration. Robert's earlier statement regarding water temperature data being interesting but of no immediate interest given its lack of forecasting opportunity, and Paul's experience of utilising the device to his personal benefit, for example, both suggest that an effective future collaborative venture would have to not only fit within but actively contribute towards their livelihood focus in the short-term. In the case of the current work then, self-interest in pursuing the fishers' respective economic and lifestyle goals effectively overrode the perceived benefits of long-term collaboration. With long-term trends not yet established beyond an ecosystem regime shift in the early 2000s (Blamey et al. 2012) and an environmental regime shift in 2007/8 (Ward et al. in prep.), the linefishers remain focussed on the short-term. In light of these challenges, the findings indicate that meeting the requirements for collaboration provided in the literature are not necessarily pertinent in the context of a fishery undergoing change and where variability is high.

Conclusion

The results of this collaborative exercise offer insight into several key factors that at times drove the process forward, and at others served to constrain the process. Motivating factors included: a shared interest between fishers and researchers in water temperatures at the start of the project; the use of participatory best practice guidelines including co-development; tied to this, the lead user approach which saw a fisher emerging as an early adopter and champion of the device; stemming from co-design, the evolution of the device building on fishers' existing technology; and finally the technical support of outside experts to overcome certain sticking points.

A series of limiting factors also served to undermine the collaborative process including: deep-seated issues of trust and mistrust that persist in the fishery; the various economic

and lifestyle motivations of linefishers; the role of the researcher as a continual presence motivating the process; and finally, the constraints of time and money within this changing fishery. Further, a declining fishery and corresponding shift in target species, fishing grounds and vessel type, and high degree of variability in the system have resulted in a shift in focus towards short-term forecasting rather than the real-time data which had previously proved beneficial to Kob fishing. Tied to this, the short-term focus has come at the expense of mid- to long-term strategies, limiting the fishers' interest in collaborations at these timescales.

Several interrelated lessons can be taken from the results of this collaborative effort. The role of the researcher as mediator and motivator cannot be underestimated. Whilst studies have previously indicated that participants are able to drive the process once a critical point of inertia has been overcome, the current work indicates that this is not always the case. Secondly, it is erroneous to assume that fishers will always engage as partners if collaboration is offered to them or be willing to continue the process to its conclusion. Lastly and perhaps most importantly, it is not necessarily enough that generic and conventional prerequisites of collaboration identified in the literature be met. The specifics of context are such that what works initially may well not work down the line (and again suggests the importance of a constant research presence in the field to continually refine the approach). The example of one fisher's early adoption of the device at sea, and his colleagues' later rejection of it evidenced these ever-shifting dynamics that drive collaborative processes. The results of the exercise thus suggest that several additional dynamic drivers, specific to the field sites, including time, personal effort, and economic focus and lifestyle goals amongst others, exert considerable influence on participants' ability and willingness to sustain collaboration.

Chapter Three: Learning for change: integrated schools teaching modules and social learning

Introduction

Learning has been recognised as contributing to the development of resilient social-ecological systems (Folke 2006; Béné et al. 2014), with improvements in learning being linked with improvements in resilience and adaptive capacity (Krasny et al. 2009; Cundill et al. 2014; Ban et al. 2015; Butler et al. 2015). In particular, social learning has increasingly become recognised as influencing adaptive capacity at a range of scales from the individual to the entire social-ecological system, imbuing them with increased ability to reorganise in the face of disturbance (Olsson et al. 2004; Armitage et al. 2008; Berkes 2009). Despite the perceived value of social learning, research in the field of resilience thinking tends to limit its focus to adult stakeholders, generally in management contexts, and within a narrowly defined set of parameters (Krasny et al. 2009). The role of school aged learners, who ultimately become the next generation of adult community members, adaptive actors, and leaders, remains under researched (Krasny et al. 2009). It is to this challenge that the current work turns, exploring the value of school learning in shaping changes in attitude in a rural, underprivileged coastal setting in South Africa, where fishing remains a significant contributor to economic and food security.

Definitions of social learning tend to focus on changes in understanding and behaviour mediated through social interations (Reed et al. 2010) in which the sharing of multiple perspectives leads to an evolving framework for understanding, decision-making, and action (Krasny et al. 2009). Keen et al. (2005: 4) define social learning in terms of the "collective action and reflection that occurs among individuals and groups as they work to improve the management of human and environmental interrelations". Krasny et al. (2009) suggest further that social learning promotes collective action with the intention of altering the system. More recently, definitions of social learning have focussed on social change through mutual learning, wherein knowledge is spread through social interactions, going beyond the individual to become embedded in larger networks, in turn bringing about demonstrable change in understanding, attitudes and behaviour (Reed et al. 2010). Social learning has also been described as iterative and reciprocal (Tidball and Krasny 2011), with actors influencing

and being influenced by their environment. Further to this, following Pahl-Wostl et al. (2007), and Berkes and Ross (2013), broader changes in group attitudes and behaviour may result from interactions with others in the social environment, highlighting the importance of social learning as a driver of change in response to systemic shifts.

Johnson et al. (2012) suggest that social learning should address four core outcomes: Firstly, participants should develop an appreciation of others' perspectives. Secondly, forging or furthering social relations and interactions between participants is key. Thirdly, participants should move towards thinking at broader scales, for instance not focussing solely on the local but also considering the status of the wider social-ecological system and their influence on it. Lastly, social learning should facilitate participatory processes that result in behavioural and action changes amongst individuals and the group. Discussing the role of evaluation processes in promoting social learning, the authors suggest that frequent, long-term engagement between researchers and participants is key and emphasise the value in additional research approaches that fill in knowledge and practise gaps (Johnson et al. 2012).

Social learning exercises have most commonly been conducted with regard to management agendas. In these instances, emphasis is often placed on the sharing of knowledge, ideas and experiences by individuals from varied backgrounds with the intention of developing common understanding and new frameworks for engaging in shared management problems (Carlsson and Berkes 2005; Armitage et al. 2008; Berkes 2009; Krasny et al. 2009; McGregor 2014). Yet despite social learning being an important component in the healthy functioning communities (Krasny et al. 2009; Cundill et al. 2014) and the potential for local people to have far more impactful influence than management agendas on the wellbeing of their community and environment (Lotz-Sisitka 2015; Lotz-Sisitka et al. 2015), consideration for those on the periphery of management processes i.e. those who do not inform them but who are affected by them, is limited in resilience research (Krasny et al. 2009). Further to this, where social learning exercises seek to involve local people, these inevitably focus on adults in the community, with little attention given to younger people as the future generation of influencers.

In a South African study of social learning and climate adaptation, Mudombi et al. (2007) found that governance represented a significant barrier to social learning and adaptation. As

social learning is an embedded, situated process, political, governance, bureaucratic, ecological, social, and economic subsystems, as well as resource scarcity all shape the form of social learning activities (Krasny et al. 2009). As such, proper social learning requires long-term engagement and an understanding of the shifting local context, with an adaptable learning structure informing the process.

The objectives of the study were to address three interrelated challenges identified during ethnographic participant observation fieldwork by way of the co-development of a series of situated, integrated teaching modules. The first challenge concerned students' and teachers' need for contextually-relevant lessons and practical exercises based on locally-derived data and examples. Respondents suggested that topics such as climate change were covered in little detail in the Curriculum Assessment Policy Statements (CAPS), the prescribed curriculum for South African government-funded schools, and issues pertinent to the local experience such as ocean warming, and overfishing were not covered sufficiently or at all. Furthermore, those lessons that did relate to environmental concerns often contained generic examples far removed from the local experience and as a result, students and teachers expressed a sense of being disconnected from many of the CAPS syllabus topics. Being under-resourced, geographically isolated and lacking sufficient funds to purchase many of the supplementary materials suggested by the CAPS curriculum, the learners were also seldom able to engage in a hands-on manner with topics. These initial fieldwork observations suggested the need for lessons and practical exercises drawn from local examples and the surrounding environment which both addressed omissions in the CAPS, and augmented those topics felt to be lacking in context. This need in turn necessitated an approach which integrated teaching methods as well as a situated approach to learning, premised on direct engagements between learners and their surrounding social and natural environments. It has been suggested that traditional rote learning is insufficient to convey the complexity of topics related to students' lives, and that a move towards problem-centred, practical teaching offers the requisite means of addressing issues in the real world (Ban et al. 2015). A focus on problem-solving and interactive, situated teaching enhances the learning process beyond the limits of conventional rote approaches, imbuing learners with the tools to tackle issues within their environment (Ban et al. 2015).

The second challenge arose from ethnographic fieldwork conducted amongst adult residents of the two towns between 2013 to 2014 and relates to a desire amongst these for information pertaining to events which directly impact community wellbeing including climate change and fish stock decline. A potential difficulty in addressing this challenge was identified during this fieldwork, however; a long-held mistrust of outsiders bringing information stemming from years of marginalisation by government. The reason for this mistrust may be in part attributed to a longstanding sense of marginalisation compounded by geographic isolation and a continued strained relationship with government characterised by limited access to information around fishing policies and rights (Gammage 2015). Residents demonstrated little incentive, and fewer means by which to improve the low adaptive capacity of the community, with recent research in the area suggesting that residents are reacting rather than adapting to change (Gammage et al. 2017). The history of marginalisation and mistrust meant that many were unlikely to attend meetings or workshops to share information. Much work is thus required for the community to move from reactive responses towards proactively formulating adaptive strategies compounded by the lack of trust and resources. Lotz-Sisitka et al. (2015) contend that where such maladaptive resilient features dominate, transformative approaches to social learning are required which initiate responses to overcome these maladadaptations, and look to actively build capacity. Similarly, Armitage et al. (2017) have suggested that that learning is an integral condition for transformation in coastal communities. The work thus looks to addresses a third challenge, seeking to initiate transformative, situated social learning in the schools with the intention that this might, in future, spread into the communities in which mistrust of outsiders negates conventional options for social learning.

Given the mistrust of outsiders amongst adult community members, the simultaneous desire amongst school teachers and learners to collaborate, and their need for contextually-relevant lessons, neither pre-formulated generic and translated curricula, nor conventional social learning exercises with adults would be appropriate. The decision was thus taken to develop an approach based on an understanding of the local needs and constraints of the schools and broader communities.

The objectives of the chapter are twofold. Firstly, it describes the process, outcomes, and challenges resulting from the co-development of a series of integrated teaching modules for

situated learning in schools. Secondly, it offers an assessment of the modules in facilitating situated and social learning in a context of marginalisation and mistrust. As such, both results and discussion sections are both split into separate co-development and evaluation phases.

Methodology

Field Sites

The research was conducted between 2013 and 2014 in the southern Cape coastal region of South Africa, specifically in the schools and broader communities of Vermaaklikheid and Melkhoutfontein. Both towns are characterised by poverty and low levels of education, as well as a rich and on-going history of interaction with the sea (Steyn 1996; Louw et al. 2006). The linefishery remains deeply intertwined in both communities with boat skippers often held in esteem. As impoverished coastal communities still reliant on fishing to supplement income and food security, and where education levels are low, and teachers welcomed an opportunity to collaborate, these two sites represented an ideal opportunity to conduct a social learning exercise with schools.

Melkhoutfontein remains geographically isolated from major transport networks, being some 40km from the N2 national highway. Vermaaklikheid is roughly 45km from Melkhoutfontein and the same distance from the N2 highway, making it even more isolated than Melkhoutfontein. In the last South African census, Vermaaklikheid had roughly 50% unemployment compared to the South African national average of 25% for the same period (Lehohla 2012). Those employed in Vermaaklikheid averaged an income of between R800 and R1600 (approx. US$58-116) per month with Melkhoutfontein faring only slightly better. With most adults in both settlements having left school before Grade 9, just 15.9% of Melkhoutfontein's adult residents held a Grade 12 school matriculation certificate (compared to the Western Cape average of 28.6%) while Vermaaklikheid's figures were even lower at just 8.7% (Lehohla 2012). Interviews with teachers and parents indicated that both schools have been working hard in recent years to address this problem, despite rising poverty and pressure on pupils to leave school with a minimum education to seek mostly informal employment.

Given the low levels of employment and education, many residents in Vermaaklikheid and Melkhoutfontein look to fishing as a cheap protein source and/or supplementary income, crewing or fulfilling other roles related to the fishery when possible (Duggan 2012; Gammage 2015). This partial reliance on fishing combines with relative isolation, distance from markets, and low-income and -education status to render those residents and their families directly and indirectly associated with fishing vulnerable to changes such as declining fish catches and shifting weather and climatic conditions (Duggan 2012; Gammage 2015).

Both Melkhoutfontein and Vermaaklikheid are home to a single school each, both of which use the South African Department of Basic Education's CAPS curriculum. Melkhoutfontein School is government-funded with a student body of some 400 learners in Grades 1 to 12, staffed by eleven teachers including the principal. All lessons are taught in Afrikaans. With a total of just 38 children from grades R to nine, Vermaaklikheid School is staffed by three teachers including the principal. Since 2008, the school has attempted to become an officially registered South African state school to secure funding from the Department of Basic Education and as such adopted the CAPS curriculum in 2013. At the time of writing, however, it remained privately funded with financial support secured predominantly through donations from individuals and sporadic funding packages from a charitable foundation based in the United States. Vermaaklikheid School is unique in the area in that, although based in a predominantly Afrikaans-speaking community, all lessons from Grade R onwards are given in English - a decision which the principal felt would be advantageous to the learners in the challenging South African economy.

Approach

The benefit of working through schools in marginalised, mistrustful communities is that schools represent more than places of learning; they are a safe location for children and, as in the case of Vermaaklikheid School, are often the only place children can expect a square meal in the day. In addition, schools are trusted centres of information for the broader community.

Long-term engagement and the contextual understanding that it offers lie at the heart of successful action research-based approaches to curriculum development (Simms 2013) and as such, the foundation of this research is built on observational and interview data

gathered through ethnographic participant observation methodology. This involved spending time observing and interacting with teachers and students in the classroom environment in both schools over a period of six months between 2013 and 2015.

Informal conversations with individuals and groups in the schools and communities were also facilitated to better understand their needs and interests and generate a sense of the local context. Further meetings with students and teachers served to identify problem areas in the CAPS curriculum and teaching syllabus as well as topics they felt warranted augmentation and/or a connection to the local context (for example, graphs in Mathematics – a problem area identified by students and teachers in both schools). During the initial lesson planning phase, group conversations were conducted with teachers, students, and combinations of the two groups in both schools; two each with teachers and students separately, and the last one with students and teachers together. Meetings were also held with students and teachers in Vermaaklikheid to plan, refine ideas, work through difficulties, and gather feedback on the modules; three at beginning, three during the implementation phase, and one at the end of the research. The interviews and conversations with teachers (aside from those conducted with the Vermaaklikheid School principal) and community members were conducted in Afrikaans and in what follows, are translated into English. Interviews with students in Vermaaklikheid School were conducted in English and those in Melkhoutfontein were conducted in Afrikaans.

In addition to ethnography, the work also drew on a participatory action approach, building on the observational data to generate practical responses to the participants' needs. This technique necessitates working closely with multiple stakeholders, incorporating different perspectives to co-develop appropriate responses to local problems on the ground (Stokols 2006), using theory and observation to facilitate practical solutions in support of community wellbeing (Brydon-Miller et al. 2003).

Working closely with local people to ensure the modules were appropriate to the context and their needs, the work drew from co-development and the concept of lead users (Harhoff et al. 2003; Morrison et al. 2004). Co-development complements a participatory action approach by placing emphasis on working directly with the end users of a product or service from inception (Morrison et al. 2004; Jeppesen and Laursen 2009) in order to ensure that the final product is both suitable for purpose and taken up as intended, by the end-

users (Fliess and Becker 2006; Ozer 2009). In the case of the modules, this meant working alongside the teachers and learners throughout the process, incorporating their insights to determine appropriate lessons structures, content, and examples.

The concept of social learning has been characterised as an important element in both individuals' and systems' adaptive capacity (Olsson et al. 2004; Armitage et al. 2008; Berkes 2009). Specifically, following Pahl-Wostl et al. (2007), social learning speeds up the sharing of experience and accumulation knowledge required to deal with change and uncertainty (Pahl-Wostl et al. 2007). However, rather than being simply a process of knowledge accumulation, it is one of understanding how best to apply knowledge to a given situation. In addition, those wishing to conduct social learning must understand and work within the governance structure that informs the characteristics, type, and scope of learning possible (Pahl-Wostl et al. 2007).

Writing in relation to the CAPS curriculum, Lotz-Sisitka (2015) suggests the conventional emphasis on education about the environment (i.e. raising awareness), whilst important, also hinders opportunities for social innovation and action. In light of calls for a more engaged and responsive education system, Lotz-Sisitka (2015: 32) cautions that a "curriculum that simply aligns with the CAPS appears to be inadequate". What is required then, is transformative social learning and sustainability education that fundamentally alters responses to environmental challenges by transforming knowledge into action. This reframing of education as action-orientated in turn requires the guidance of "interpretive actors" who facilitate the transformative process (Lotz-Sisitka 2015: 32).

In their study of problem- and project-based learning courses for sustainability students at the university level, Brundiers and Wiek (2013) suggest that sustainability education often falls short of its goals by not fully integrating participatory and experiential learning components in a practical manner. This concern with applying sustainability thinking in a hands-on manner informed the structure of the modules such that they incorporated immersive practical and experiential exercises in the surrounding environment. The modules thus incorporated techniques from situated learning (Krasny et al. 2009; Tidball and Krasny 2011), a paradigm that shifts the traditional environmental education lens from a focus on environmental knowledge driven by content to knowledge driven by action (Krasny et al. 2009). It has been suggested that learning approaches based on interaction

between students and their environment, incorporating the perspectives of different actors, are useful means of building resilience whilst facilitating improved education and learning (Krasny et al. 2009; Tidball and Krasny 2011; Ban et al. 2015).

Placing emphasis on "interactions among the learner and the social and physical environment" (Krasny et al. 2009: 2), situated or place-based learning moves beyond viewing students as passive recipients of knowledge, empowering them to become active stewards who take responsibility for building resilience in their community and local environment. Within this paradigm, it is suggested that "education not only may be *about* resilience as a concept, but also may guide students in *fostering* resilience within the…neighbourhood, or other social–ecological system in which they work and live" (Krasny et al. 2009: 3 emphasis in original). In this way, situated learning builds a foundation for social learning by embedding lessons in real-world social-ecological environments, interactions, and practices (Krasny et al. 2009; Hilburn and Maguth 2011). Similarly, activity theory places emphasis on interactions between learners and other elements or members of their social-ecological system (Ban et al. 2015). Three principles form the foundation of place-based education: integrated teaching across subjects; interaction between students and their local community and environment; and an interactive process of learning in which students focus on local issues and develop means of addressing these (Hilburn and Maguth 2011). Research amongst school learners to assess the efficacy of place-based and problem-centred education to improve air quality, for example, has demonstrated a strong correlation between practical, embedded school learning and practical improvements in community responses to pressing environmental problems (Johnson Duffin and Murphy 2012). In what follows, the term situated learning is used as a blanketing term encompassing these various place-based, activity-based, and experiential approaches to learning.

The CAPS curriculum is by no means situated and displays what Fogarty (1991: 61) refers to as a "fragmented model" of curriculum design, with individual subjects taught in discrete disciplines, by different teachers. This has the effect of giving learners a fragmented understanding of the curriculum (Fogarty 1991), with no linkages or overlaps being demonstrated between subjects or lessons. Given the limitations of the fragmented model, and the perceived shortcomings of the CAPS voiced in the schools, but their coterminous

dependence on it, the intention behind the work was to augment the curriculum but not replace it. To this end, the work took the form of a series of integrated lessons and modules which in turn could be integrated into the CAPS curriculum. Although the CAPS is the dominant mode of teaching in South Africa, integrated approaches do exist but are essentially limited to a small number of privately operated Waldorf and Montessori schools. Both systems focus on experiential learning and an integration of subjects and topics (Barnes 1991; Rathunde 2001; Lillard 2006; Lillard 2013). However, while Vermaaklikheid School, for example, with its multi-age classes echoes central tenets of the Montessori approach (Lillard 2006), it has to be kept in mind that in South Africa, Waldorf and Montessori schools are typically located in urban centres, privately owned and catering to affluent middle-class families.

Despite these differences, the integrated approach holds value for the schools in which the work was conducted, particularly in light of the Montessori system's successful early development and application in a context of poverty (Lillard 2006). Following Lake (1994), an integrated curriculum is interdisciplinary in nature, combining subjects to a greater or lesser degree, placing emphasis on project and group work, source material beyond textbooks, drawing on themes as organizing media, and forming relationships across concepts and conventional subject boundaries. Importantly, the integrated teaching approach has been shown to create connections which can extend into life outside the school (Drake and Burns 2004).

Data Collection

Open-ended ethnographic interviews with adult residents centred on their contact with the students through the homework exercises to gauge whether contact had been made between the students and their community, and what conversations had been initiated. In addition, respondents were asked whether they would be interested in participating in further research around these topics in the future, and whether they felt the topics had been beneficial to the students and their community.

In addition to the methods described above, further methodological details are provided in the results section as a means of explaining the results.

Results

The research occurred in two phases: the co-development phase in which collaboration with students and teachers resulted in the creation a series of integrated teaching modules; and an evaluation phase in which the efficacy of the modules in addressing the identified challenges was assessed via an evaluation of follow-up interviews with students, teachers, and community members relative to the established characteristics of social and situated learning in the literature.

Phase 1: Creating the modules

The first phase of the research pertains to the first of the challenges identified during the initial fieldwork: the need to augment the CAPS curriculum.

Initial meetings were conducted with teachers in 2013 and learners in 2014 to determine topics likely to benefit from local examples and practical exercises. Follow-up meetings (again with the teachers and students separately) were held to ensure that all relevant concerns were voiced. It was felt that separate meetings for teachers and students would allow the students the space to voice their opinions without a teacher present (a scenario in which some learners may have deferred to the teacher or felt unconfident voicing their opinion). Results of these meetings were fed back to the entire group (teachers and students together) to assure all topics had been adequately accounted for.

To ensure the modules adhered to established didactic structures, the co-development process incorporated experts at critical stages including the scientific outreach co-ordinator for the University of Cape Town's Marine Research Institute, and a respected senior Cape Town high school science teacher to identify appropriate subjects and topics. In consultation with these educators, and Melkhoutfontein and Vermaaklikheid teachers, it was agreed that a supplementary curriculum could not replace the CAPS, nor clash with the regular teaching syllabus. Neither could it run for the duration of the year given Melkhoutfontein teachers' concerns around teaching experimental material during examination terms. The decision was thus taken to design individual integrative teaching modules taught over periods of one to five days in the third term of 2015 and first term of 2016. The external education experts suggested beginning with two subjects; Mathematics and Science. This list was expanded to cover four subjects after workshops in the schools and a literature review highlighted the

potential of English and Art in providing additional benefits to the overall integrative teaching and learning experience. Specific topics identified included: climate change; ecosystems; biodiversity; food webs; data handling; public speaking; English comprehension; relevance of mathematics beyond the classroom; pollution; the marine environment; global warming; ocean acidification; rising sea levels and temperatures.

The next step involved working with the teachers to incorporate these topics in lesson plans. Given that the modules had to fit within the CAPS curriculum structure and syllabus timeframe, and with most teachers being specialised in one subject, these constraints saw the modules being developed along the lines of what Fogarty (1991) categorises as a *sequenced* model of integration. This model sees topics taught separately but arranged in a sequence such that lessons in different subjects relate to and complement one another and speak to a broad, overarching theme (Fogarty 1991).

The schools' lack of resources and access to adequate teaching materials were a constant concern and every effort was made to keep costs to a barest minimum. Teaching materials from a wide range of sources were consulted (Appendix 2) to ensure that the lessons were in line with current knowledge and approaches to teaching the various topics. These sources were worked through with the teachers to adapt the exercises to the local context and to ensure that they understood the. Exercises taken from teaching material published by Conservation International (Quesada et al. 1999) and the New South Wales Office of Environment and Heritage (Papp and Thompson 2003) were particularly instrumental in informing the structure of the practical exercises. Whilst these are older resources, they contain field-tested exercise templates which were simple to adapt to context and implement.

The selection of relevant grades for which to structure the lessons was determined largely by Vermaaklikheid School's understaffing issues with Grade 7 to 9 learners taught simultaneously in the senior classroom and communicating these effectively across the spread of ages and cognitive abilities.

The modules served three key objectives: (i) improve the schools' access to knowledge, data, and practical exercises around issues pertinent to the local context and felt to be lacking in the CAPS; (ii) provide learners with the knowledge, action thinking, and skills to

enhance their individual and community resilience and adaptive capacity; and (iii) initiate conversations beyond the school in support of future learning in the communities.

Whilst the modules were co-developed by teachers in both schools, Melkhoutfontein School was unable to fully engage with the process to the point of deployment, with only Vermaaklikheid School ultimately integrating the modules into their curriculum. A sense of uncertainty and hesitation amongst the Melkhoutfontein teaching staff about teaching additional material dominated. Discussions with the teachers indicated that while they were excited by the prospect of potentially bolstering their students' academic performance, they were anxious that the integrated modules not interfere with their strictly controlled syllabus. During a meeting with Melkhoutfontein School's principal in mid-2015, it was explained that, due to a spate of consistently low test scores across all Grades, the Department of Basic Education had placed a set of strict controls on the school which hindered their ability to deviate much from the CAPS curriculum. As such, teachers in Melkhoutfontein were wary of implementing experimental modules in their syllabus, expressing a concern around the time and effort required to adapt their syllabus. Ultimately, this hesitation resulted in the staff deciding to adhere strictly to the CAPS curriculum and not implement the modules in their teaching.

Phase 2: Evaluating the modules

After the first year of teaching the modules (Appendix 1) had been completed, in March, April and August of 2016, a combination of group feedback sessions with students and teachers, and follow-up ethnographic interviews in the community were conducted to establish the efficacy of the modules in addressing the three challenges identified earlier in the work, as well as gather feedback on future improvements and areas requiring attention. The interviews garnered feedback on the implementation process, as well as ascertaining whether learners had interacted with community members and initiated conversations around topics related to fishing and climate change. In the group sessions, students and teachers were asked their perception and experience of the modules. They were encouraged to discuss what they did or did not like about them, whether their understanding or thinking around topics had changed in any way, what insights they had gained, and what elements they felt could be better structured, made more accessible, or

taught differently. In what follows, the results of these interviews and feedback sessions are presented.

Discussing the spread of information through their communities in interviews conducted in 2013, had teachers suggested that lessons learnt in school were often filtered through to the broader community via conversations between learners and their families and friends. Following the Vermaaklikheid School principal:

> *…you see, these children, they go home, and they talk with their siblings and the old people listen as well (laughing) we sometimes hear about what we've taught them months ago at a community meeting.* (Principal Zeelia)

Capitalising on this, another intention underpinning the modules was that they facilitate conversations and the spread of information beyond the classroom. Practical exercises and homework projects with a place-based focus tasked students with interviewing their parents and community members about fishing, the impacts of sea temperatures, and other marine changes, and to report their findings back to their class the following day. Feedback from the learners indicated that the process had been a reciprocal one, with the learners gleaning information from the community and in return sharing information via the homework exercises.

> *I also liked speaking to my daddy about fishing…he caught lots of fish (in the sea) and my brother used to (catch) lots but now it's less.* (Gr. 8 learner V2016VM)

> *Yes, I learnt a lot from speaking with my uncle about (fishing). He told me how it has changed a lot since when he was my age.* (Gr. 8 learner S2016VF)

Feedback from parents of Vermaaklikheid learners in further suggested that the students' interactions with their community, had served to inform them of concepts such as climate change, changes in the marine environment and fishing conditions:

> *My daughter told me about the climate change – you hear it every so often on the news on TV, but I never knew what it really was. Now she explained it to me…I am a fisherman but, in the past, maybe 10 years, I don't get to go to sea much. All the places we fished before are empty. The wind blows so strong now we can't get out*

the river mouth as much… It is interesting to think now how what my daughter is learning in class, I am seeing when I am working. (Parent of two learners, M2016VH)

The interview excerpt above highlighted the value of the situated approach to learning in stimulating conversations between generations and the exchange of knowledge around local conditions but also in relating these to broader topics such as climate change. The localised interactions also had the effect of stimulating further discussion between adult community members around these topics:

…the kids told me about it when they came to ask me about fishing…I told them it's totally different now – completely - where's all the (fish)? ...I was talking to (another parent) about it – he has a boat. It used to be an easy lifestyle – now it's (hard). (Parent of two learners in the Gr. 7-9 class, retired fisherman Z2016VC)

Interviews with community members during this follow-up fieldwork indicated an interest in discussing further how they might mitigate against changing fishing and climatic conditions.

(My nephew) came with his friends to me asking about the fishing. I told him, it's been bad here for years now. We hardly go out anymore…there are those of us who want to know what can be done. We still only really know fishing…other jobs I do now because I can't fish so much…you see we don't know much of what's going on…What must I farm? Is there a thing I must grow that will make a success or provide food for the people here? These things we want to know, but (the government) does not tell us. (Resident A2016VJ)

By linking local conditions to thinking about larger systems, the modules also served to expand the learners' worldview, encouraging them to think at broader scales:

I have learnt all about ecosystems and biodiversity… I also liked speaking to my daddy about fishing. He is not a fisherman, but he likes to catch it from the river. He caught lots of fish (in the sea) and my brother used to (catch) lots but now it's less and the wind is stronger now so there's not so much fish. (Gr. 8 learner V2016VM)

An example of this broader thinking was the link between a marine water temperature measuring project and the school. In this way, the learners were encouraged to consider how lessons learnt in the classroom related to research into changes in the broader system.

In an isolated setting, this move to create links to the outside world represented an important step in encouraging the students to see themselves as embedded within a larger system.

> *We also saw how maths is helpful when you are working. I like the story of the fisherman taking the sea's temperature and then we are using the temperature to make graphs and those graphs can show you what is changing in the sea – I can see (where) the numbers come from and why it is helpful for the scientists.* (Gr. 8 learner V2016VM)

In addition, the integration across subjects discussed by learner V2016VM above was reiterated by learner L2016VZ, who suggested that the process rendered topics easier to understand:

> *It makes sense for me to see how the lesson we learnt in English read about water temperatures – how that is also something that is important in Science and then using the numbers in Maths – that for me made it easier to see how it is actually all one thing.* (Gr. 9 learner L2016VZ)

Another key element in this systems thinking perspective was the explicit use of the surrounding environment as laboratory and classroom. Where teachers and students had identified a lack of context and relatable examples in the CAPS-mandated textbooks as posing a challenge in the didactic process, feedback from learners in 2016 indicated that by relating abstract concepts to more concrete examples sourced from their surroundings and integrating topics across subjects the modules rendered topics more readily accessible. As such, the modules' use of situated learning exercises emphasised practical engagements as a means of creating tangible links for learners between classroom lessons and real-world experiences and examples.

> *For me, I liked the exercises outside – it's nice to learn not in the classroom. Like you can touch something and see it in your hand then it makes a lot of sense to me. With books, it's sometimes harder.* (Gr. 8 learner S2016VF).

One of the learners suggested that the engagement with their surroundings reinforced the lessons and made them more readily accessible:

> *When we could go out into the (playground) and do a (biological) survey…for me, to see how the lesson in the classroom is real in the nature right here outside, that was*

> *interesting so – we learnt about the food webs and about the environment but if you can then afterwards go and really see it, then it's more real – it makes it easier to understand some things.* (Gr. 9 learner L2016VZ)

Whilst these are established didactic practices in many schools, it must be noted that in the context of Vermaaklikheid, the learners have not previously been exposed to such a wide and varied range of resources. Further, the practical activities were designed to equip the students with knowledge tools (largely unavailable to their parents and other adult community members) to better understand and deal with pressing social-ecological issues. This hands on, situated approach - going beyond conventional rote learning – encouraged the students to engage in practice, improvising and adapting their new knowledge to address local challenges beyond the classroom.

In this way, the strong emphasis on interactions between the students, the local natural environment, and members of their community represented a shift away from traditional environmental education driven by content towards the sharing of knowledge for action. As such, students learnt about the conditions and challenges facing their social-ecological system, developing insights and strategies to tackle these.

The ability to link lessons in the classroom to issues in the local environment and the subsequent impact on behaviour cannot be understated. As an example of this, an interview with one of the students revealed a plan to tackle a local pollution issue:

> *We have learnt that the sea is important for us and our community. I never thought about it before really – we just get the fish and eat it but thinking about how the river pollution can be bad for the fish and how we can eat that fish. We learnt that with the food webs lesson. That makes me think about how people must stop pollution in this river. Also, it goes into the sea. We are going to do a clean-up of the river by the (public slipway)* (Gr. 8 Learner M2016VL)

The decision to conduct a river clean-up proved an important result of the study. Not being part of the modules, nor suggested by the teachers, the decision was motivated by the students alone after observing the state of the slipway area in their free time.

Beyond the integration of subjects, the modules were also formulated to integrate different teaching media, a step which proved useful in two ways. Integration enabled learners to more readily understand concepts from different perspectives:

> *…we read about it then if I don't understand something, the video will show it differently. Then when we wrote a test on it, or did a poster I understood it…and being able to go walk outside to do a survey - that was cool. We don't do those things ever, so it's nice to see the things from the lessons in real life.* (Gr. 9 learner L2016VZ)

Given the mix of grades taught simultaneously, the use of different media also enabled younger learners to more easily understand concepts, keeping pace with older learners:

> *I like the videos…some things are difficult and then I see my (Grade 9) friend is doing the work but I must ask teacher...The videos are nice because I can see things and then I can understand them.* (Gr. 7 learner B2016VF)

The integrative design of the modules, intended to mesh with the CAPS enabled them to be taught without interrupting the syllabus or demanding additional time from students. Follow up interviews with teachers in Vermaaklikheid in August 2016 indicated that they had also benefitted from the teaching modules. The principal's feedback suggested that the use of tangible examples from their daily lives had rendered the lessons successful in enabling the learners to engage with the subject matter and to start thinking about how the topics they learnt about were impacting their community and the local environment.

> *(The modules have) made a huge difference to teaching things like graphs which the kids didn't like before. A lot of the little ones didn't get it, you know? …using the exercises and the data from here…it's something they can relate to…plus the fact that you have chosen our kids for this work, it makes them excited to be a part of something beyond the tiny world they see (in Vermaaklikheid) every day.* (Principal Zeelia)

Discussion

The discussion section below is divided into two parts, each corresponding to a phase identified in the results. The first section discusses the process, outcomes and challenges encountered in co-developing the integrated teaching modules. The second part of the discussion provides an evaluation of the modules with regard to contemporary situated and social learning approaches as well as their efficacy in addressing the three challenges identified at the beginning of the work.

Phase 1: Creating the modules

By involving both teachers and students in the formulation of the modules, the co-development process ensured that these were relevant, understandable, and readily adopted (Neale and Corkindale 1998; Ozer 2009; see also Jeppesen and Laursen 2009) in Vermaaklikheid. Long-term buy-in is evident in the running of the modules since the end of the first phase reported in this study with only quarterly telephonic contact between researcher and teachers necessary to sustain the process.

Linking common threads between subjects and lessons, and backing these up with mixed media, the integrated approach also served to render the modules more understandable to the learners. Learner L2016VZ's suggestion that the integration of subjects and topics rendered the graphing of water temperatures more understandable, and learners L2016VZ and B2016VF suggested that the ability to link readings mixed media such as videos and posters reinforced these lessons and facilitated a greater understanding of topics, these responses reiterated the value of relating lessons and exercises to one another (Satchwell and Loepp 2002) and to the local context and experience (Krasny et al. 2009; Hilburn and Maguth 2011).

Encouraging learners to engage with their social and natural environment to conduct practical exercises, and address real-world problems (Johnson et al. 2012; Lotz-Sisitka et al. 2015), the learners' surroundings became a source of examples and fascination, reframed as an extension of the classroom. Here learners S2016VF and L2016VZ, for example, suggested the value of connecting the classroom with tangible examples from their surroundings, enabling the students to more readily understand the connections between classroom learning and real-world phenomena, a comment repeated by the school's principal. The

feedback regarding being taught in a variety of media which were engaging and accessible as well as practical speak to the value of the integrated approach in allowing teachers to build a more comprehensive picture of a topic for their students through the linking of subjects and the use of supporting media (Lake 1994; Satchwell and Loepp 2002).

Where Melkhoutfontein School is bound to the CAPS curriculum, Vermaaklikheid School, although it subscribes to the CAPS, was more readily able to incorporate contents of the teachers' choosing due to its continued private school status. Melkhoutfontein School's inability to implement the modules highlights several related factors. The first of these concerns the school's diminishing academic performance in recent years and the teachers' ultimate wariness and decision not to implement the modules in their syllabus. This scenario is referred to by Satchwell and Loepp (2002) as high stakes testing; where a school's academic performance is low or on the decline, teachers and administrators are often reluctant to adopt a new and unknown approach to teaching. Similarly, Simms (2013) notes in her work on experimental curricula that experienced teachers are often less likely to adopt a new curriculum, particularly one which requires a testing phase, which challenges established standards or the existing curriculum structure. This latter point was evident amongst some of the Melkhoutfontein teachers, particularly the more senior amongst them, who, at a late stage of the modules' development, expressed reluctance at translating lessons into Afrikaans or spending additional time after hours planning the integration of lessons with their existing syllabus. Whilst it is possible that results of successful integrated curriculum implementation in other institutions may be used as both proof and motivation, in the case of the Melkhoutfontein School, the prospect of high stakes testing proved too significant a hurdle given the academic record and pressure from the Department of Basic Education.

In such a context, a tension arises regarding the optimal approach to teaching. The first group calls for innovative, committed and reflexive teachers who work flexibly with the curriculum to accommodate learners and ensure that all members of the class participate in lessons, and the other, for disaffected, indifferent, non-reflexive employees who work in strict compliance with bureaucratic controls (Tickle 2001). In the situations described in this work, both perspectives have been evident. The principal of Vermaaklikheid School, for example, went to great lengths to ensure that all concerned arrived at workshops and

meetings, and that all perspectives were heard and accommodated. By comparison, the principal of Melkhoutfontein, feeling pressure from the Department of Basic Education, while initially accommodating of the research, was not able to motivate the teachers to implement the finished modules. This result suggests the role of school leadership as gatekeepers in the collaborative process.

Phase 2: Evaluating the modules

Where the successful co-development, deployment and continued teaching of the integrated teaching modules in Vermaaklikheid addressed the challenge of augmenting the CAPS curriculum originally identified by the fieldwork, in what follows, the further two challenges are discussed: the opening of conversations within the broader community; and stimulating social learning in the school.

Learning has been suggested as a means of improving adaptive management (Johnson et al. 2012) as well as a crucial condition for transformation in coastal communities (Armitage et al. 2017). From the initial fieldwork and observations, it was apparent that a deliberate, transformative, and situated learning approach was necessary to address the perceived shortcomings in the CAPS curriculum and in light of the state of reactivity and low adaptive capacity which characterise the Vermaaklikheid community. Following Cundill et al. (2014) and Lotz-Sisitka et al. (2015), where such changes are desired, transformative social learning, structured with the intention of equipping participants with new knowledge and ways of thinking can serve to improve adaptation and transformation. In this regard, the work looked at fundamental elements of the community, starting with school learners as the foundation for new ways of thinking, questioning, learning and acting. Reed et al. (2010) caution, however, that not all social learning leads to pro-environmental or sustainability thinking. In order to evaluate the efficacy of the modules in addressing the question of whether pro-environmental, transformative social and situated learning has occurred in Vermaaklikheid School, the work refers to the guidelines offered by Johnson et al. (2012) Budwig (2015), Hilburn and Maguth (2011) and others.

The goal of transformative social learning following Budwig (2015), should be to provide learners with situated, deep, and developmental learning that shapes future adaptive experts. The isolation of Vermaaklikheid offered both a need and opportunity to encourage the students to think at broader scales, and assume a role as participants in a broader

system undergoing change, a hallmark of social learning (Johnson et al. 2012). Where learner V2016VM, for example, spoke of changes in the ecosystem and the "fisherman taking the sea's temperature", or learner M2016VL described a sense of understanding the connection between the health of the river and that of fish caught in the sea, the students' feedback suggested an expanded worldview in which they had begun to consider the impacts of changes beyond the local village setting on their lives as well as the impacts that local changes exerted in the broader system.

The process of interactive learning focussed on local issues, and means of addressing these reinforced this thinking, and is characteristic of both situated and social learning (Hilburn and Maguth 2011; Budwig 2015). Situated learning also requires an integration across subjects (Hilburn and Maguth 2011), a step achieved through the use of Fogarty's (1991) integrated curriculum design, with the modules structured such that topics were taught across subjects (Appendix 1). Further, it requires interaction between students and their local community and environment (Hilburn and Maguth 2011), a step evidenced in the feedback interviews with learners, parents and other ocmmunity members. Lastly, a situated approach should emphasise an interactive process of learning in which students focus on local issues and develop means of addressing these (Hilburn and Maguth 2011), for example where the students engaged in the river clean-up.

Going beyond rote learning, connecting classroom lessons with hands-on, outdoor exercises that encourage students to adapt their knowledge (Budwig 2015) explicitly reframed the surrounding environment as an intriguing and inspirational place. Such interactions with the environment served also to reinforce lessons with tangible examples as described by learner S2016VF's assertions of being able to make a connection with lessons through touch and sight, deepening the learning process. Making the connection between classroom lessons and practical experiments was unprecedented in Vermaaklikheid and, following Armitage et al. (2008), this process of engaging practically with problems relating to the subject matter enables learners to develop their own knowledge of a subject by reflecting on the issue, conceptualising a solution and using experimentation and their experiences to address it. In this way, situated, experiential approaches have been shown to be useful in teaching about resilience in social-ecological systems (Ban et al. 2015).

By engaging in practical learning and interaction with their surroundings in this way, students' worldview and capacity to act are developed and expanded, resulting in changes in behaviour (Johnson et al. 2012; Budwig 2015). True social learning then is not simply education *about* the environment, but *for* it, manifesting as changes in thinking and behaviour (Krasny et al. 2009). The strongest evidence of this shift in attitude and behaviour towards active stewardship was the learners' decision to undertake a clean-up at the public slipway as mentioned by learner M2016VL. Whereas before the modules, attitudes towards pollution were characterised by indifference, now, equipped with a deeper understanding of the effects of pollution in their ecosystem and the food web that they and their community relied upon, the students wished to take action. Discussions amongst the students following the conclusion of the food web and ecosystem modules compelled them to ask what they could do to better their environment. The surrounding environment and community thus became sources of knowledge and data, echoing Hilburn and Maguth's (2011: 28) suggestions that place-based learning should emphasise "the use of local resources, people, and environments to engage students in learning about and bettering their community". It is this transition from rote learning towards adaptive expertise in that results in behavioural changes and action (Johnson et al. 2012; Budwig 2015) – evaluating a challenge and adapting newfound knowledge to address it – that suggests the true value of the integrated modules and working in schools to stimulate behaviour and attitudinal changes. It should be noted, however, that such a success may be fleeting and without further follow-up fieldwork and support, it is impossible to say whether this initial action will become a repeated behaviour.

The dual lens, turning the focus of learning towards the local community and environment, and simultaneously encouraging participants to consider their place and influence in the broader system enables participants to understand their position relative to the wider world, and work towards bettering their environment (Hilburn and Maguth 2011), a powerful potential outcome of such an exercise. As places of learning and safety, schools also serve a vital function in the communities as trusted gatekeepers of knowledge, and bridging organisations (Berkes 2009) facilitating a scale step by lifting learning from the level of the individual students to that of the community. In other words, the school acts as a nucleus for potential social learning; learners approaching community members as part of a

school project, for example, do so with the backing of their school, which lends its trusted reputation to the students and those researchers who wish to gather or disseminate information. It is this implicit trust which renders community members more likely to listen to the learners and willing to share their knowledge. However, it should be noted that in this role of trusted gatekeeper of knowledge, schools also pose the risk of spreading inaccurate information, highlighting the necessity of turning to outside experts and verified sources in the formulation of projects intended to facilitate social learning.

Through the hands-on approach of the modules, learners were encouraged to more deeply connect not only with the surrounding ecosystem but also with community members who engaged with the natural realm as a means of deriving a livelihood. Johnson et al. (2012) suggest that the development of an appreciation of others' perspectives and a furthering of social interactions are hallmarks of social learning. Similarly, Hilburn and Maguth (2011) suggest that interaction between students and the local community is a requisite of situated learning and Reed et al. (2010) suggest the new understandings born out of social learning often go beyond individual boundaries, becoming embedded in the larger local community.

With regards to these notions of interaction, follow-up interviews with students and community members also suggested that both groups had interacted and begun to develop an appreciation of others' perspectives. This step was evidenced, for example, through learners H2016F and V2016VM's discussion of a newfound interest in their family members' experiences of fishing, and where parent M2016VH spoke of his interest in his daughter's explanations of climate change that resonated with his own experience.

The results of these interactions are important in the context of marginalisation given Reed et al.'s (2010) suggestions that if individuals begin to learn and adapt, learning within the broader networks is possible if a critical mass is reached through interactions between individuals. It is precisely these niche, local levels at which broader transformations are catalysed (Lotz-Sisitka et al. 2015), again highlighting the value of working with schools as catalysts of future transformations. Community members' willingness to talk further, as espoused by community member A2016VJ's desire to know what plants to farm in addressing a changing climate thus suggests the possibility for future conversations and broader pro-sustainability learning in the community, further highlighting the value of integrated, situated learning and the role of the school as nucleus of future social learning.

Conclusion

Based on findings of ethnographic research in Vermaaklikheid and Melkhoutfontein Schools, this Chapter set out to present the process, outcomes, and challenges resulting from the co-development of a series of integrated teaching modules for transformative, situated social learning. Despite the productive co-development of a series of integrated teaching modules and their successful implementation in Vermaaklikheid, the risk of high stakes testing hampered Melkhoutfontein School's implementation of the modules.

The findings of this work suggest three contributions which the integrated teaching modules and associated process might offer to would-be action researchers interested in social and situated learning outcomes. Firstly, in a situation where schools are governed by conventional top-down, discrete, rote learning approaches, it augments the CAPS curriculum with practical, situated lessons embedded in the local context, improving the school's access to knowledge and practical exercises relevant to learners' context and moving beyond typical 'top-down' approaches to community education.

Secondly, within a context of mistrust and a lack of access to resources to facilitate social learning at a community level, the modules have initiated the first steps towards opening conversations around pressing social-ecological challenges. Thirdly, in educating in more place-based, problem-centric and integrative ways using the surrounding social-ecological system as a point of stimulus and encouraging interactions with the environment and community, it provides learners with action thinking and knowledge, encouraging them to formulate new understandings and take action to enhance both their and their community's adaptive capacity. In so doing, it expands the focus of social learning beyond engagement between adults of the present generation, to developing resilience thinking and adaptive expertise within the current generation of high school learners and highlights the value of working with learners and schools for social learning in this way. In a context of rural poverty where options for leaving the community are severely limited, it is even more pressing that the future generation be equipped to deal with changing social-ecological conditions.

The findings also suggest the critical need to understand the local context and challenges in order to formulate an appropriate response. It is not sufficient to simply translate generic

curricula into the local language. Rather, the subtleties of circumstances on the ground may be used to good effect in structuring lessons that are meaningful and make a difference in students' lives. Further, the role of the researcher as both facilitator and mediator in driving the process forward is key, as are teachers in sustaining the process in the long-term.

In a context of marginalisation and embedded mistrust, in which conventional social learning is not possible, the research suggests that schools might be effective bridging organisations to opening conversations with communities, if such a process is carried out slowly, with genuine respect for local circumstance and needs, and genuine dialogue. The combined situated-integrative teaching approach offers the field of learning in social-ecological systems thinking, particularly in a context of rural poverty, mistrust, and low levels of education: a more subtle, long-term take on fostering attitudinal and behavioural changes to bolster adaptive capacity in individuals who form the next generation of adult stakeholders and community leaders.

Chapter Four: The changing tides of social capital: linefishers' associations and organisations in the southern Cape

Introduction

Coastal communities often find themselves vulnerable and under pressure to adapt in order to successfully navigate changes in the social-ecological systems in which they are embedded (Bennett et al. 2016). South Africa is no exception with many of the country's coastal communities having been identified as vulnerable (Glavovic and Boonzaier 2007). Within this context, traditional linefishers operating in the southern Cape region have been shown to be vulnerable to a range of social-ecological impacts (Gammage 2015). Under such circumstances, social networks and groups including informal associations, formal organisations, collectives, and cooperatives have been shown to positively affect a number of outcomes, including wellbeing, political participation, collaboration, communication, management, economics, and transformation of fisheries (Hauck and Sowman 2001; Kitts and Edwards 2003; Martin 2008; Simmons and Birchall 2008; Brinson et al. 2011; Afanasjeva 2012; Jacobsen et al. 2012).

The social capital resulting from membership in such groups, and the collective action which may result have been shown to impact on the adaptive capacity (Bennett et al. 2015), and resilience of participants (Folke et al. 2005; Bennett et al. 2014). In social systems exposed to the impacts of climate change, for example, adaptive capacity is constantly modified through interactions between people (Pelling and High 2005). Further, with vulnerability and adaptation closely linked (Brooks et al. 2005; Adger 2006; Smit and Wandel 2006; Cinner 2011), understanding how groups are constituted, fail, or succeed is integral to working with vulnerable fisheries. To this end, the chapter adopts a perspective proposed by Pelling and High (2005), suggesting that a social capital lens provides insight into the critical social bonds and interactions that shape and govern the adaptive capacity and resilience of both individuals and groups.

A foundational definition of social capital conceptualised it in economic terms as the "personal resources individuals derive from membership of a group" (Bourdieu 1986 in Purdue 2001: 2214). In his influential study of the subject, Putnam (2001: 1) suggested that "the central idea of social capital…is that networks and the associated norms of reciprocity have value". The term 'value' here, however, represents not only economic worth but also

wellbeing and other social benefits such as learning, knowledge sharing, access to outside information and innovation (Putnam 2001). Similarly, Pelling and High (2005: 313) suggest that social capital is constituted through "relationships built on norms of trust and reciprocity", which compel members of these networks to act towards collective interests. One of the simplest definitions, at least on the surface, posits social capital as "the level of trust among people" (Chloupkova et al. 2003: 241). However, this definition is complicated by the authors' intimation of a graded system which suggests that trust falls along a continuum. The concern with assuming levels of trust is that trust and social capital are notoriously subjective and thus difficult to measure (Scrivens and Smith 2013). Further, it is the contention of this thesis that attempting to measure levels without an objective metric detracts from the more salient features of relationships such as the different ways in which people trust one another and how these affect those relationships and broader social networks.

Grafton's (2005) work on the other hand, suggests that there are different forms of both trust and social capital and that acknowledging and working with these different forms (as opposed to trying to measure these concepts) is a more productive approach to working with social capital. Following Grafton (2005) three forms of social capital are most common: 'bonding', 'bridging' and 'linking'. 'Bonding' social capital is exhibited in highly localised social ties that bind small groups of similar outlook together and regulate the behaviour of members (Scrivens and Smith 2013). In other words, a form of in-group identity which serves to both create and maintain a separation between those deemed part of the group and those deemed outsiders (Pretty 2003). A group of fishers operating in the same town, for example, might display 'bonding' social capital by self-identifying as local fishers and adhering to certain norms. 'Bridging' social capital expands the scope of social bonds and represents the effect of connections between groups with similar characteristics but operating in different areas or displaying different methods or views (Pretty 2003; Grafton 2005), for example where linefishers from different towns collaborate. 'Linking' social capital describes networks and connections spanning groups and hierarchies of power (Grafton 2005). A fisher engaging in personal communication with a fisheries manager or government scientist, for example, could be said to be mobilising 'linking' social capital given the parties' different foci and the hierarchy of power which separates them.

The concept of trust is also central to many definitions of social capital and has been suggested as the crucial component in its creation and maintenance, as well as a vehicle to improve cooperation (Newton 2001). The conventional conceptualisation of trust is premised on the conviction that the person being trusted will follow an ethical code which compels them not to exploit a situation to the detriment of others (Purdue 2001). This conventional form of trust is termed *goodwill trust* and is often described using terms such as emotion, reciprocity and honesty (Purdue 2001). A further form, *competence trust*, is based on the belief in the ability of an individual or organisation - their capacity, expertise and experience - to "(meet) their commitments" (Purdue 2001: 2214). In other words, competence trust is generated on a foundation of confidence in the party's proven ability to do something and is not dependent the existence of goodwill trust. Lastly, *political trust* describes "an evaluation of the political world", expressed as belief in an individual or group garnered from a distance through secondary sources (Newton 2001: 205). A common example is a voting citizen who has not met a politician but expresses trust in them or their organisation.

In addition to trust, strong, responsible and charismatic leadership has been identified as perhaps one of the most influential determinants in building social capital in successful groups, particularly those that display a sustainable business model (Purdue 2001; Maak 2007). In a study of 130 fishers' cooperatives around the world, for example, Gutiérrez et al. (2011) confirmed that the greatest determinant in their success was strong leadership, which in turn fostered strong social capital. Purdue (2001) suggests that 'transformational leaders' – charismatic visionaries with the entrepreneurial skills to manifest their ideas – are key in building social capital in groups, while Maak (2007) outlines a similar form of accountable, 'responsible leadership' in which a morally-directed leader is key in building and sustaining social capital in groups.

Trust and social capital are vital in the South African commercial linefishing sector, which has long faced vulnerability to dynamic economic, political, ecological and climate stressors (Sowman 2006; Isaacs et al. 2007; Gammage 2015). In the southern Cape, declining catches (Duggan 2012; Gammage 2015), longstanding resource competition with inshore trawlers (Visser 2015) and a legacy of marginalisation by government (Duggan 2012; Visser 2015; Gammage 2015) have placed linefishers in a vulnerable position (Gammage 2015). This

situation was compounded further on 31st December 2013, when the fisheries section of the Department of Agriculture, Forestry and Fisheries (DAFF) released the results of its revised Fisheries Rights Allocation Process (FRAP), the assessment through which fishing rights for the commercial handline fishery are allocated. Prior to the FRAP, 450 licensees had been active along the South African coastline, of which roughly 50 were allocated in the study area at the start of the fieldwork. Each license is granted to an individual right holder and covers that person's chosen vessel and full crew complement (of up to 8 fishers), enabling them to fish commercially under one license. Following the FRAP, these licenses were cut to just 215, leaving thousands of fishers without employment (Moolla 2013; Moolla 2014). In early 2014 the South African Commercial Linefish Association (SACLA) sought legal action against DAFF, which subsequently declared that linefishers would only be allowed to communicate with the Department through formalised fishers' organisations. This stipulation combined with the impending legal action spurred the rapid formalisation or reaffirmation of linefishers' associations along South Africa's coastline. The newly formalised organisations began to operate with mixed results; some running in parallel to informal networks that operated at a range of scales from highly localised partnerships to networks spanning towns and even regions. Others forced fishers with personal differences into association with one another. In Mosselbaai, the linefishers' organisation had operated successfully for decades prior to the FRAP and continued to do so throughout the fieldwork. By comparison, Stilbaai's organisation had faltered for years prior to the FRAP with few of the town's fishers enrolled as members, and by mid-2015 had been officially dissolved. At this point, looking to sustain their position in the fishery, Stilbaai linefishers turned to alternative networks or organisations, or petitioned to join Mosselbaai's linefishers' organisation in order to access information as a buffer against changing conditions.

The southern Cape linefishery has traditionally relied on Silver Kabeljou (*Argyrosomus inodorus,* known locally as Silver Kob or simply Kob) as a primary target species. Kob is also an important targeted bycatch ("joint product") component of the southern Cape's inshore sole trawl (Greenston 2013), pitching the handline fishery against trawling companies - well-capitalised, highly organised, and well-represented in their dealings with government - for over a century (Visser 2015). Many locals, particularly poorer community members, continue to rely on fishing as a source of food security and income (McCord and Zweig 2011;

Duggan 2012; Gammage 2015). The combination of declining catches and competition have thus had ramifications beyond the harbour wall, placing increasing pressure on fishers to sustain their livelihoods or lifestyle.

In addition to the above challenges, an emergent form of collectivisation will likely further compound pressure on the commercial linefishery. The Policy for the Small Scale Fisheries Sector (SSFP) (DAFF 2012), proposed in mid-2012 as a poverty alleviation and racial transformation strategy is scheduled for roll-out in 2018. The SSFP will provide fishing licenses to cooperatives of small-scale fishers in coastal communities along the South African coastline including the southern Cape, mandating that they operate these as collectives (DAFF 2012). Many of these communities are already home to commercial linefishing based on individual rights, and the SSFP collectives will target a basket of species directly overlapping with the linefishery, potentially leading to competition between these two small-scale linefishing sectors.

Given the challenges facing the southern Cape linefishery, and the importance of factors such as leadership, trust, and social capital demonstrated in other studies of fishers' collectives and resilience, using a social capital lens, the objectives of this chapter are to explore, via observational and interview data, the causes underpinning the relative success and failure of the neighbouring linefishers' organisations in Mosselbaai and Stilbaai. Success here is taken as continual functioning of an organisation or association including retaining membership and securing members' buy-in to its policies and undertakings. Failure, on the other hand, describes a break-down of membership and a lack of interest in collaborating towards the goals of the collective.

Methodology

Study sites

The choice of research sites was informed by the towns' relatively close proximity to one another, shared history of commercial linefishing, targeting of the same fish species and similar fishing grounds, and seemingly disparate responses to the formalisation of the linefishers' organisations following the FRAP.

Stilbaai's linefishery evolved with the town's primary development as a holiday destination in the late 1800s and by 1940, commercial linefishing began in earnest with the construction

of a small harbour in 1933 (Steyn 1996). In the early 2000s, an abundance of shallow-water Hake (*Merluccius capensis*) saw an influx of commercial handline fishers to the town and as many as sixty-five commercial skiboats – typical linefishing craft up to 9m in length made of wood and fibreglass and powered by outboard engines. Despite the short-lived increase in landings, however, Stilbaai's economy remained stagnant in part due to its geographic isolation, being some 40km from the N2 national highway and the closest railway junction and in part due to the history of market control by established companies which operated their buying and processing business out of urban centres such as Mosselbaai and Cape Town (Visser 2015). At the time of research from early 2015 to mid-2017, some twenty-five commercial handline boats remained licensed in Stilbaai with fewer than ten of those fishing on a regular basis.

Mosselbaai's linefishery evolved as part of a suite of different fisheries based out of the large commercial harbour (berthing vessels of up to 130m) constructed in the late 1800s (Visser 2015). With the presence of natural gas fields and a refinery, the town is a key energy supplier and exporter in the South African economy (PetroSA 2017). Its location next to the N2 national highway along with a railway terminus represented attractive conditions for inshore trawling companies that established themselves early in the harbour's development (Visser 2015) and linefishers were thus forced from the outset to coexist with the trawlers and forge effective means of sustaining their livelihood. Despite fish stocks and conditions being considered better adjacent to Stilbaai, Mosselbaai's geographic positioning and infrastructure marks it as a more conducive situation than Stilbaai, in which to conduct commercial fish sales and distribution.

Approach

Data collection was based on ethnographic participant observation amongst linefisher-skippers and/or boat-owners in both Stilbaai and Mosselbaai as they are the decision-makers in the commercial linefishery and the most closely involved in formal linefishing organisations. The fieldwork involved spending up to six months at a time in the field from 2015 to 2017 working with a total of thirteen linefishers and two fish buyers, attending fifteen formal and informal meetings, facilitating several discussions, fifty-four individual and group conversations, nineteen open-ended as well as semi-structured interviews, and, in addition, interacting with the fishers in their workspace on land and at sea as they went

about their lives. The bulk of interviews were conducted in Afrikaans and have been translated into English. For the purposes of anonymity, in what follows, all fishers' names have been changed.

In the South African linefishery context, the terms 'association' and 'organisation' are used interchangeably. However, drawing from Johnsen et al.'s (2009) definitions, in what follows *associations* are herein conceptualised as informal social collectives constituted through dynamic, unbounded social linkages with tacit rules of membership and purpose which result in the incremental and unplanned development of the group's structure and function. *Organisations*, on the other hand, describe associations with more formalised structures exhibiting an explicit intention and function from the outset, and adhering to bureaucratic principles (Johnsen et al. 2009). The distinction in the present work is pertinent given that linefishers retain memberships of formal organisations (such as local fishers' organisations recognised by a national linefishers' body), whilst maintaining links to less formalised associations and networks of association as well.

Results

The rapid formalisation of fishers' associations into organisations resulted in two very different outcomes in the research sites. In Stilbaai, the organisation disbanded within 18 months. Its counterpart in Mosselbaai, however, grew in strength and economic prosperity, even attracting some Stilbaai fishers. During this time, several recurrent themes emerged from the fieldwork. These included: different forms of trust and social capital; the role of leadership in organisations; a divisive focus between, one the one hand, a semi-retirement lifestyle, and on the other, a drive to maximise profits; and the role of alternative organisations and associations. The following results unpack each of these themes, highlighting them with excerpts from ethnographic interviews.

As circumstances changed on the ground, so too did the scale and kinds of networking and social cohesion that the fishers engaged in to navigate the systemic disturbances including declining catches, rising costs, greater distances to fishing grounds, and the repercussions of the FRAP court case. Observations and interview data suggested that various forms of trust played out in different contexts and at a range of scales from the level of individuals to small groups and on to that of the organisation.

Speaking in mid-2016, two fishers, one based in Mosselbaai and the other in Stilbaai, discussed their fluctuating collaborative relationship:

> *…(people) take it seriously! It's nice when it works though. Me and (Paul) had a good run for a while. Then we had a falling out…But then we picked it up again last year…you've got to trust the other (guy) and that's hard…I guess it's best if you know him…like he's your friend and you know each other…only then you can make that partnership work...* (Stilbaai fisher Jeff)

> *…it works for a while I guess...you start up a friendship with (a guy) on the quayside…and then maybe one day you tell him where there's a (shoal) of fish when you're on your way back full (chuckles). But it can be (hugely) productive hey! If one of you is out, looking for the fish and the other (guy) is on the shore, he'll help you out with petrol, split some of his catch. So, it can work that way… I worked with (Jeff in Stilbaai) so I would tell him "look, here's fish" and give him my GPS co-ordinates and then he'd tell me when there was fish in Blombos if it was enough to justify me travelling all that way…but then he starts sharing my (GPS) marks with other guys in Stilbaai. And that didn't work. (*Mosselbaai fisher Paul)

Despite their changeable collaborative efforts, the foundation of trust between the fishers was built on notions of a shared history, friendship, reciprocity and the resulting goodwill towards one another that compelled them to collaborate at times.

Following this theme of friendship, in an interview with Mosselbaai skipper Paul in early 2016, the conversation turned to his decision to work for a fellow Mosselbaai skipper. Asked about their working relationship, the skipper discussed their ability to work together despite a lack of trust or friendship:

> *If a guy knows his stuff and he works hard, that's all I can ask. Like (Joe) for example - I don't trust him – you can be outside (the fishery) we wouldn't be friends – but he's got a (lot) of experience, he's good at business and running his license and that…so that was definitely a big part of my decision to work with him, ja.* (Paul)

This more utilitarian competence trust was described by Stilbaai fisher Gordon:

> *I've never trusted these guys at sea or on land. But I'll tell you what, I trust them to look after themselves. And if you're in an (organisation) with them, and they're all fighting to look after their rights, that means they'll look after you - you're aligned with people who will make that (organisation) great, because they know it is the only effective legal way to deal with government, right?* (Gordon)

This sentiment was shared by Mosselbaai fisher Joe. Discussing a lack of friendship, but a simultaneous trust in their ability to get the job done, the fisher suggested:

> *…you don't maybe have to like a guy, but if he's reasonable, and you're reasonable and you both know that you want to make a profit and you can see "look, this is how it can be done and we have to work together to make it happen, keep our customers happy, to keep our market safe, and to keep our business open", then you make it work…We stick together here to make money. Not because we are buddies. Because we are businessmen and the walls are pushing in.* (Joe)

In these interviews, the recurrent theme which emerged was one of confidence in a fellow fisher or the organisation – a competence trust that existed in the absence of goodwill trust. By mid-2017, despite not having a relationship with the chairman of the Mosselbaai organisation, two further members of the Stilbaai fishery had joined Mosselbaai on the basis that they regarded this as a well-run body that would protect their interests. In an interview with one of these fishers, the respondent specifically mentioned the reputation of the organisation's leadership as compelling him to join:

> *For me, you see, I need an (organisation) – without it, why am I paying fees for court cases and such? No, I must have an organisation to secure my trade. That (president of Mosselbaai organisation) has a reputation as a strong businessman, and, I can say, as someone who can run a tight ship…so for me, I know other people who have told me he's good at it… Also, if you look at (the organisation), when I talk with (the local Stilbaai fish buyer) you can see they're successful man – just look at their (vehicles) and that – when they come here for weekends you can see we're the poor ones.* (Stilbaai fisher Adam)

Despite not knowing the Mosselbaai organisation's leader, through feedback from his colleagues and a local fish buyer, and having observed their success from afar, Adam had

developed a confidence in the Mosselbaai organisation and leadership to the extent that he was willing to join based on his observations and their good name in the region. This belief in an entity or individual, despite not having personal experience of it, reflected a sense of political trust in the Mosselbaai organisation.

Different forms of trust, rapport, and reciprocity between individuals are not limited to the individual scale but rather feed into various networks to create and foster different forms of social capital. One such example was a strong sense of bonding premised on a shared identity as "locals". This localism may also be mobilised as a defensive mechanism, fostering an in-group mentality as a protective measure against outside forces. In response to a question in early 2016 about his decision to retain membership in the Mosselbaai organisation despite a lack of goodwill trust or friendship for his fellow members, fisher Paul suggested:

> *Why am I in this organisation? (pauses) because it's us or them. And "them" can be DAFF or it can be anyone who wants to try take our licenses or our fish away, you understand?* (Paul)

Another Mosselbaai fisher expressed a similar opinion, stressing the importance of an organisation in affording fishers' political representation:

> *Without an (organisation), you have nothing really. You don't have a voice, you can't bargain, you won't get anywhere. Especially…now when the government doesn't care for us or what we do…So now, with an (organisation), you have a voice. You are a political organisation. You have views and you must be taken seriously...that's important when you are working in a place where government doesn't listen to you but it wants to help the big guys above you, and the little ones below, you understand?* (Robert)

In these two interviews, the fishers alluded to a sense of "us versus them", with the organisation serving as the unifying body for a group of locals in their dealings with DAFF. Similarly, discussing the importance of working together towards a common goal, another of the Mosselbaai fishers stated:

> *It has to work otherwise you find yourself alone – at sea and in the market. Then you are sunk my friend. Because that means you are facing now DAFF and the trawlers, and those buyers – all of it – alone… Those guys that get angry or don't want to work with others? Let them go out on their own and see how they go. They don't last.* (Joe)

Aside from offering support and representation through unification, the organisation also served to regulate the behaviour of its members. Mosselbaai fisher Paul, for example, described the impact of the organisation in curtailing the behaviour of those who did not contribute equitably to the organisation:

> *…if one guy doesn't pull his weight – then when the fish buyer comes, he's just not going to get to sell his fish to him. The (organisation heads) will stop him from selling it. Then he's sitting with fish but no sale – so he must go to the tackle shops and sell it as bait (chuckles).* (Paul)

With Kob catches on the decline, in mid-2015 the fishers in both towns shifted their effort to a fish species known locally as 'Silvers' (Carpenter seabream, *Argyrozona argyrozona*), located on reefs far offshore, usually in the 40-50km range. Prior to this shift, most trips had been within 10-20km of the harbour. Mosselbaai was home to six linefishing vessels - four 'deckboats' and two skiboats - during the fieldwork. Deckboats are the same length as skiboats but considerably larger in volume (DAFF 2013), and are able to travel far greater distances to sea. Given their increased carrying capacity and basic amenities, they are also able to spend days rather than hours at sea. With their harbour unable to accommodate the larger deckboats, Stilbaai skippers were forced to continue operating their smaller skiboats, ill-suited to the distances and dangers faced when targeting Silvers.

The greater distances required to catch Silvers drove costs higher and placed Stilbaai fishers in a position of uncertainty with the risk of not catching enough fish to cover costs. Uncomfortable in this new, forced mobility, some Stilbaai skippers began to turn to counterparts in Mosselbaai, creating and/or renewing alliances to more efficiently and safely target the fish. At the time of research, Stilbaai skiboats were almost all skippered by their owners. However, in Mosselbaai, the deckboats were skippered by freelance skippers. This distinction between owner-skippers and freelancers created an opportunity for 'bridging' social capital. Not being boat owners, the freelance skippers were not obligated to

keep sensitive information such as reef locations to themselves. With the Mosselbaai deckboats undertaking a maximum of two to three trips per month (of three days each) to target Silvers, these freelance skippers had time to fish for other boat owners, particularly on skiboats which conducted shorter trips, often less than 12 hours. It should be noted that such bridging relationships also existed between boat owner-skippers, but these were less common.

In the emergent bridging networks, Mosselbaai deckboat skippers would identify shoals of Silvers on the fishing grounds. Returning to the harbour, the deckboat skipper would either inform his Stilbaai associate(s) of the coordinates or drive to Stilbaai and guide the skiboat skipper to the location, splitting the profits of this catch. In this way, the Stilbaai fishers could better mitigate the risks, time, and cost of locating the fish, and the deckboat skippers, having no boat of their own, increased their personal profit share. Again, however, such associations were often fleeting.

One Stilbaai fisher described this relationship and explained the necessity of the Mosselbaai deckboats' GPS marks:

> *Yes, look, I must trust (my collaborator from Mosselbaai), of course. We are working together and I am relying on him to give me the right (GPS) information. But then, of course, I am also making my boat available to him and splitting the (profits) with him so he must trust me too.* (Adam)

These GPS marks enabled Stilbaai skiboats to head directly to a specific reef without the need to search out a shoal. In this way, these longer trips were rendered safer and less costly. Knowing precisely where a shoal of Silvers was located thus became a necessity:

> *(pointing to GPS screen) – you see these points? Those are from (Paul). Without these, it's pointless… You can't carry enough fuel (on a skiboat) to get there and then still look for the fish… If you don't have (GPS) points from a (deckboat) you're (in trouble) …If we want to survive now, we've got to work together but that means relying on those (Mosselbaai) guys.* (Jeff)

Further to the 'bonding' and 'bridging' social capital mobilised in the fishery, limited instances of 'linking' social capital were also observed. In 2015, for example, the chairman of the Mosselbaai organisation mobilised personal contacts in the fruit export sector to foster

lucrative fish export contracts for himself and the organisation's members. Mobilising contacts outside of the linefishery in a similar way, the chairman of the Stilbaai organisation drew on personal contacts in DAFF to secure additional information during the FRAP process and subsequent court case in the wake of his personal falling out with the chairman of the South African Commercial Linefish Association.

Fishers in both organisations consistently related the accomplishments – or perceived lack thereof – of their organisation to its leadership, referencing this as an important determinant of success and motivator for membership. Talking with the first of the Stilbaai fishers to quit the local organisation and join Mosselbaai, the fisher made the following comments in reference to the Mosselbaai organisation chairman's entrepreneurial capacity:

> *With (the chairman), you know he may be (difficult), but he'll work with you because he's a businessman – so it's more open – they're helping each other there because they understand if you work alone…you're sunk…* (Jeff)

In this interview, Jeff expressed a lack of goodwill trust in the chairman, but a simultaneous competence trust in his entrepreneurial ability. Another prominent Mosselbaai fisher suggested a strong competence trust in the organisation chairman's leadership ability, with specific reference again to his entrepreneurial skill:

> *Ja, with guys like (organisation chairman), you might not like them, but…if you're part of (the organisation), you benefit. But also, you can see that (the chairman) knows what he's doing in business – like really knows how to make money, and that trickles down to everyone else…* (Joe)

Another Mosselbaai member reiterated the importance of business-minded leadership:

> *…so if you're willing to work with (the organisation head and secretary) and listen, they can actually teach you a lot…they pulled this (organisation) into shape even before when the whole (FRAP) came – it's a good place to be fishing because of them and the stuff they've done like changing (from skiboats to deckboats) and making sure the guys ice their fish and keep quality higher than other places…you need that sort of businessman as a (chairman) if you want to treat fishing seriously as a business. That experience is (very) important.* (Paul)

Further to entrepreneurial capacity, Mosselbaai fishers suggested that they were willing to follow the chairman due to his willingness to listen to others and act fairly.

> *…ja like when (a Stilbaai fisher) and I had a fight about the 'riem hou' story, (the chairman) stepped in…he listened to us both and worked it out…he's fair like that. It's good to have a guy like that who doesn't take sides, he knows it's about the long term…* (Paul)

Fellow fisher Joe shared a similar insight:

> *The thing with (the chairman) is, he's honest. And he will listen to everyone. He doesn't want to dominate and that's really important – guys get sick of that fast, you understand?* (Joe)

Discussing his reasons for joining the Mosselbaai organisation, Stilbaai fisher Jeff commented:

> *…if you have a problem with a guy or with him (the chairman), you can pick up the phone and tell him. That's huge! Here (in Stilbaai) never! He's there for his guys, you check? Like he'll make a plan for you, sort you out.* (Jeff)

As much as these interviews revealed a sense of accountability and reliability on the part of the Mosselbaai chairman, one Stilbaai respondent suggested that the opposite was true in the Stilbaai organisation's leadership and underpinned the failure of their organisation as well as his decision to approach Mosselbaai's chairman with a view to joining their association in early 2016:

> *Every guy in (the organisation), especially if he's in a - how can I say – an important position, like secretary or whatever, he wants to use that to get something. You can't trust that guy because now he has information or money and he wants it for himself…now you can think how that will affect an (organisation) when it's trying to form – it can't. It's like making a (loaf of) bread but you forgot the flour to bind it all together!* (Philip)

Citing a failed attempt by the Stilbaai chairman to cut out fish-buying middlemen by purchasing a freezer truck and cold storage unit, a former Stilbaai organisation committee member ascribed the leadership's failure due to a lack of entrepreneurial skills:

> *…he has no clue how to organise his guys…he and (Philip) tried for years to get that ice truck and the cold storage (unit) going – they couldn't get it right…now you expect me to believe they can get us better prices for our fish if they can't even sell theirs? …I need results and in (Mosselbaai) they get results. Consistently.* (Robin)

Similarly, in early 2015 discussing the court case against DAFF resulting from the FRAP, another Stilbaai fisher suggested that the town's fishers had been unwilling to contribute towards membership fees or the national organisation's court case out of both a mistrust of the local organisation's financial stewardship and leadership:

> *No man, that guy's not a leader (laughs)…No one wanted to pay (towards membership fees or the court case) because they didn't believe it was a real (organisation) I think.* (Jeff)

Despite being from neighbouring towns, Mosselbaai and Stilbaai's fishers displayed a considerably different economic and lifestyle focus. In Mosselbaai, the necessity of protecting the market and securing better prices for the catch in the face of competition from the inshore trawl industry saw a mobilisation of strong 'bonding' social capital amongst the linefishers, paired with a focus on maximising economic gains. Entrepreneurial capacity was also touted by the chairman as a foundational principle underpinning the organisation:

> *You see, we are* businessmen*. We run this like a business, not like a playground.* (Robert)

Fisher Joe contended that his decision to move to Mosselbaai was underpinned by economic drivers:

> *…we here have made a choice – to live and fish in a big town…we go to sea come rain or shine, and drive our boats to Stilbaai and past it…but then we bring it back here and sell it faster for better money. I must work 5 days a week if I can – sometimes more. Because here it is a job…* (Joe)

Mosselbaai fisher Robert echoed these sentiments, describing the strategic decision to base themselves in the commercial harbour:

…in Mosselbaai, people don't move here to fish because it's nice and relaxed. It's a (pauses) strategic decision I can say…we came because it has a fishing industry established…We didn't move here for the good fishing – we have to go to the [Alphard] Banks to catch our fish! Stilbaai is much closer to that. (Robert)

Where the Mosselbaai fishers were drawn to the town by its infrastructure that would facilitate their enterprise, Stilbaai fishers had settled in the town for a different suite of reasons which did not focus solely on profit margins.

Philip moved to Stilbaai in the early 2000s to capitalise on the Hake bonanza. As he neared 60 years of age, he had come to rely increasingly on his sons to run his skiboat, spending his days working on his commercial bee hives. Discussing the dwindling catches and the prospect of leaving the town for more productive fishing grounds in early 2015, the fisher commented:

My sons are here, my family, friends – and what must I do – leave and go spend more money just to take a chance? No, my friend, I'll take my chances here with what I've got, stick with what I know and what I know works. (Philip)

Having worked previously on a deckboat, George explained his choice of lifestyle as an easier alternative:

Ja man, you know, those guys in Mosselbaai are working too hard (laughs)...I worked on a deckboat for a few years out of (Port Elizabeth) but that's (hard) work…the fishing today is a way to live the way I've always wanted to and to get paid for going fishing (laughs)… But I have other things to make some money as well with my (livestock) and my wife is working a good job... (George)

The fishers' augmentation of fishing income by relying on his wife's job and supplementary income from livestock farming referenced the common strategy amongst the Stilbaai fishers of relying on combinations of alternative or passive income streams to supplement fishing and sustain their lifestyle. Following fisher Jeff, for example:

(laughing) No man, I don't want to work in Mosselbaai…it's too much hard work what they do over there (they) take it too seriously! Changing to (larger deckboats) to (compensate) for less fish – travelling so far (to find fish) …that's expense…I'd rather

save money and fish when I can from here and relax, you know…if it's really (bad) for ages and I can't get to sea, the panel beating and that helps. (Jeff)

Similarly, fellow Stilbaai fisher Stuart had for years relied on alternative income strategies to support his move from Mosselbaai to Stilbaai as a form of semi-retirement:

I came here to Stilbaai on holiday when I was a (child)…I was working (in Mosselbaai) and when it came time to leave there, I asked myself, "where do I want to live now"? …that workshop I have now, it supplies me with work throughout the year… I am working on boats, motors, trailers… It makes it easier when there's no fish... (Stuart)

From these interviews, a distinction between, on the one hand, an economic motivation amongst the Mosselbaai fishers, and on the other, a lifestyle focussed more on flexibility expressing itself through a combination of fishing and other strategies in Stilbaai became evident.

Following the dissolution of their organisation and demonstrating little interest in cultivating 'bonding' social capital between themselves, the Stilbaai fishers were left vulnerable to further disturbances in the fishery. Despite this lack of social capital, however, they still required representation and access to information. Fieldwork conducted at this time revealed that, in response to the need for continued access to the information, representation and sense of community afforded by social capital, the fishers maintained or sought membership in various alternative networks of association in the form of voluntary and civic organisations. Options included the rate payers' association, local Rotary club, church congregation, community policing forum, and recreational angling club (whose membership included several retired commercial fishers). Additional support was also found in a ward councillor and municipal tourism bureau supportive of commercial linefishing and a working harbour as tourism draw cards.

Speaking with Philip towards the end of 2016, the fisher suggested:

(laughing softly) *…people say, "I'm retired now in Stilbaai, I go fishing when the weather's nice" but actually you end up working quite hard and having to make a plan to keep living this life!* (Philip)

During this conversation, the fisher's comment about 'making a plan' spoke to more than alternative income streams. Rather, the fisher alluded to a range of associations and organisations that he and others drew upon to build social contacts and a sense of community around themselves.

In a follow-up interview in mid-2017 discussing the role of alternative associations since the official organisation's dissolution, Stilbaai fisher Jeff commented:

> *...you know, we go to church and I volunteer sometimes for the (Rotary) club helping the old people and such…and because (my wife's) mother owns the house (we live in), we belong to the rate payers' association – they're all good ways of staying in touch, you (understand)? You won't* believe *the people (who are) in those (associations) – lawyers, professors, bankers, all kinds of people!* (Jeff)

During this same series of interviews, Philip's son and fisher Zack discussed his response to the failed organisation:

> *Ja look, you need some kind of thing to be a member of now – to get information from the people…and so they can hear your side of it I think. For me and my father (Philip) that's joining the policing forum and the guys in the (recreational) angling club…the (angling) guys especially, they know all the people in DAFF and they know exactly what's going on - more than (the former Stilbaai organisation's chairman) even.* (Zack)

In the absence of a formal fishers' organisation then, these various networks and organisations offered an opportunity for the fishers to make contacts and open communication channels, aligning themselves with the social capital necessary to accumulate sufficient representation and information to pursue their lifestyle goals.

Discussion

The story of the Mosselbaai and Stilbaai fishers' organisations and networks of association is one of the creation and erosion of trust and social capital. Indeed, trust is fundamental to the formation of social capital (Purdue 2001). As such, understanding how trust forms, functions, or is lost provides insight into its resultant impact on the fishers' associations and organisations as well as into why these succeed or fail.

In the interviews with Jeff and Paul above discussing their fluctuating collaborative relationship, a sense of longstanding friendship and reciprocity was evident. The nature of trust expressed in these exchanges was premised on friendship, honesty and respect. These characteristics have been suggested as key components of goodwill trust (Purdue 2001), the kind of mutual, reciprocal confidence conventionally referenced when people discuss notions of trust. However, given the volatile and shifting nature of collaborative relationships in the linefishery observed in the fieldwork, goodwill trust is tenuous and fleeting and may render trusting participants vulnerable to exploitation, in the case of Jeff and Paul, for example, in which sensitive information was shared with others outside of the relationship. Jeff and Paul's responses were also typical of the ever-shifting dynamics of trust and social cohesion evinced both within and between the towns. Some twelve months after their interviews, for example, the two fishers again initiated a collaboration which again exhibited 'bridging' social capital and lasted almost four months. This dynamic and constant evaluation of the state of the social world speaks to the impact of constantly shifting social relations and interactions that in turn create new senses of trust and cooperation on an ongoing basis (Newton 2001).

In cases where goodwill trust has eroded, alternative forms of trust may be mobilised to foster social connections. Despite voicing their lack of mutual goodwill trust, for example, Robert, Paul, Jeff and Joe's trust in the Mosselbaai organisation to further their interests was sufficient to sustain their membership and cooperation. Where Gordon suggested a lack of goodwill trust in fellow members but simultaneously noted their ability to "look after themselves", this competence trust, a form of confidence in the *ability* of others, was based on past interactions and observations which suggested the ability to generate benefits for trusting collaborators that they would otherwise not be able to derive on their own (Purdue 2001). Competence trust is distinguished from goodwill trust by a focus not on reciprocity and emotional connection but rather on the innate aptitude and skills of the trusted actor(s), a feature which was prominent in Mosselbaai. Importantly, the fieldwork observations and interviews suggest that competence trust can operate in the absence of goodwill trust if the individual or organisation is judged to be skilled at their task and have a proven track record of accomplishment. Competence trust also expresses a belief that the collective will be able to control risk far better than the individual, thereby working to

improve responses to vulnerabilities (Purdue 2001). This was expressed by Joe, for example, when the fisher described the organisation as a voice and buffer in the fishers' dealings with government. Viewed in this light then, in the context of the field sites, trust between individuals was less important than trust in the ability of an organisation or its members to adequately represent their interests.

When two additional fishers joined the Mosselbaai organisation in mid-2017 based on recommendations from colleagues in the Stilbaai fishery, a third form of trust, political trust became evident. In this instance, the third-party validation of the Mosselbaai organisation's good name and political position by fellow Stilbaai fishers, and his own observations of its members' wealth were sufficient to compel Zack to join. These findings resonate Newton's (2001) observations that political trust operates over distances, spread by word of mouth and without requiring direct contact between parties for trust to be built. Despite the lack of personal connection in this instance, political trust nonetheless acted as a compelling means of binding people together and enabling action across distances (Newton 2001).

From the interviews and observational material, it is apparent that goodwill trust is not a prerequisite for belief in the organisation or its leadership. Indeed, it has been suggested (Rose et al. 2011) that goodwill trust does not necessarily lead to political trust or confidence. In a study of voluntary organisations, Newton (2001: 201) found "very little evidence that membership of voluntary organizations (have) much of a relationship with individual attitudes of trust". That is, where people join organisations voluntarily, trust in their fellow members premised on conventional goodwill is immaterial. Rather, they join on the understanding that doing so will derive benefits from membership (including social capital) that outweigh the benefits of not joining (Newton 2001).

Trust then, is multifaceted and different expressions of trust are underpinned by different motivating factors. Various shades of trust and motivations thus foster connections in the fishery. These forms of trust are apt to shift in line with people's relationships and conditions on the ground, mirroring the complex dynamics of the social interactions they are embedded in. Where Chloupkova et al.'s (2003) earlier definition speaks of *levels* of trust these are difficult to measure and, considering the findings of the current research, it is perhaps more appropriate to speak also of different *types* of trust and how they interact.

Within such amicable structures, supported by responsible leadership, social cohesion is encouraged to thrive. Following Maak (2007), 'responsible leadership' is instrumental in the creation and maintenance of social capital. Critically, Maak's (2007) work on leadership suggests that top-down leadership structures that promote a leader-follower relationship do not readily lead to the creation of social capital. Rather, successful responsible leadership relies on the establishment of symmetrical relationships of accountability and responsibility between leaders and members of the group (Purdue 2001; Maak 2007). Paul's reference to the Mosselbaai chairman's successful conflict mediation, Joe's suggestion that the chairman listened to all members without dominating and Jeff's reference to being able to contact the chairman with grievances or suggestion that the chairman was "there for his guys" all spoke to characteristics of reliability and accountability to the organisation's members.

Further to characteristics of reliability and accountability, the role of entrepreneurial leadership cannot be understated (Purdue 2001). Joe's suggestion that the Mosselbaai chairman was accomplished in business, for example, displayed a competence trust in the chairman's entrepreneurial nous, a sentiment echoed by Jeff. Characterisations of the Mosselbaai chairman by organisation members suggested that his leadership followed a pattern of 'social entrepreneurship', also described as 'transformational leadership' (Purdue 2001), displaying a strong, equitable and organisational leadership with clear vision for the future. The chairman's sourcing of export contacts, competitive ability in the face of the inshore trawling companies' dominance of South African markets, and ability to elicit collaboration from his peers all pointed to a strong social entrepreneurial focus, a hallmark of effective transformational leadership (Purdue 2001).

The research also indicated that fishers mobilised a range of networks and forms of social capital at different times in order not only to benefit their enterprises but also to sustain their lifestyle or ensure political representation or the wellbeing of the group. These results suggest, in line with previous work on the subject (Raiser et al. 2002; Chloupkova et al. 2003; Scrivens and Smith 2013) that social capital is multifaceted and highly dynamic, providing not only economic gains but also the possibility of improving wellbeing in a social-ecological system.

The most prevalent form of social capital evident during the fieldwork, 'bonding' social capital speaks to the notion of shared values and emerges from highly localised ties that act

as social linkages between individual. These result in close-knit groups with shared objectives and identity (Pretty 2003) – and are often expressed via an 'us and them' mentality (Bowles and Gintis 2002). Amongst the fishers, 'bonding' social capital was mobilised primarily in response to outside threats. As an example of this, Joe and Gordon both described the value of the organisation in buffering and providing a voice in their dealings with government. These sentiments are in line with Gutiérrez et al.'s (2011: 388) conceptualisation of social capital as dual purpose tool in both the protection, and facilitation of social networks, suggesting that it "serves as a buffer against changes in institutional arrangements, economic crises and resource overexploitation…". In other words, the value of the organisation here is the social capital and protection it offers to members, effectively bolstering resilience by reducing vulnerability.

When fishers began to collaborate to find fish, linkages were forged between individuals and groups across Mosselbaai and Stilbaai, resulting in a regional network of cooperation (Grafton 2005). Such linkages are hallmarks of 'bridging' social capital, and may result in technological improvements and other benefits for participants (Grafton 2005). Furthermore, such cooperative bridging has been shown to accrue higher yields whilst decreasing risk for participants (Bowles and Gintis 2002), a finding echoed in the current work. In the collaborative partnerships described above, for example, in which Mosselbaai deckboat skippers worked with Stilbaai skippers, the Stilbaai collaborators were able to limit the additional costs of searching for the fish further offshore and find fish more quickly, whilst the Mosselbaai skipper-partners benefitted from profit-sharing. Further, in receiving coordinates for shoals, the Stilbaai skippers were able mitigate against the added risk of travelling greater distances to sea in their smaller skiboats by being able to spend the minimum of time in search of the fish. In these partnerships, both goodwill and competence trust were deployed in various combinations. Whilst most of the 'bridging' social capital was fleeting, it nonetheless proved beneficial for those participants able to sustain it. These loose collaborative networks of association demonstrated a high degree of mutability in their formation and boundary maintenance, most often based on a handshake and a promise to keep each other informed of fish movements, or pool resources. Such collectives have been termed 'organic associations' (Johnsen et al. 2009). As suggested in the fieldwork observations, these organic associations demonstrate fluctuating levels of

cooperation and conflict and develop incrementally in response to practical concerns (Johnsen et al. 2009).

While Mosselbaai fishers displayed a focus on economic prosperity, citing the town's economic positioning as influencing their decision to operate there, their Stilbaai counterparts were often more concerned with maintaining a lifestyle focussed on semi-retirement and supplementary income strategies to bolster this. Both outlooks were strongly influenced by context. The juxtaposition between, on the one hand, a sleepy retirement and holiday town with access to fishing grounds but limited access to markets, and on the other, a large and thriving industrial centre with access to networks of capital and distribution, but greater distance to the fish, continues to play an important role in the divergent developments of the fishers' organisations.

In a study of the creation and destruction of social capital in European farmers' collectives Chloupkova et al. (2003) found that as commercial farming operations developed alongside traditional small-scale operations, the former began selling the latter certain production essentials as well as buying their produce. A hierarchical division of capital and power emerged with a resultant exploitation of small-scale farmers due to their position of dependence. In response, farming collectives gained rapidly in popularity, with members pooling resources to compete with the commercial farms (Chloupkova et al. 2003). Similarly, the roots of the Mosselbaai fishers' entrepreneurial focus have a basis in the genesis of the construction of the harbour, the advent of which pitched linefishers against inshore trawlers (Visser 2015). Like the European farming collectives, Mosselbaai linefishers have a history of buying bait, ice and fuel from the trawling companies and selling their catch to them. Further, this relationship is characterised by an imbalance of capital and power with the trawling companies controlling access to infrastructure and resources and as such, the linefishers have had to evolve into a strong collective to maintain prices and their place in the local market. In light of this pressure, the organisation adopted elements of a 'mechanistic association', in which the fishers adopted and adapted formalised structures and internal management protocols (Johnsen et al. 2009). By comparison, their Stilbaai counterparts, for the limited duration of their formalised organisation, continued to operate as a loosely constituted *ad hoc* organic association with informal membership and limited internal structure or plans (Johnsen et al. 2009).

The economic success of the Mosselbaai organisation compared to their Stilbaai neighbours is in contrast to Knack and Keefer's (1997) suggestion that membership in formalised organisations does not provide economic advantages relative to those who choose not to engage in collaborative relationships. Where Mosselbaai fishers focussed on fishing as their primary income source with the organisation acting as a vehicle to pursue both political and economic goals, Stilbaai's fishers looked to sustain a lifestyle which balanced fishing with semi-retirement.

As a more isolated town with limited markets, those fishers who had moved to Stilbaai were compelled to engage in the sorts of alternative income strategies described by fishers Stuart and Jeff. Moreover, the town's development as a retirement and holiday destination were clearly motivating factors underpinning the fishers' decision to settle, with Stuart, for example, citing his childhood memories of holidaying in the town driving his decision to move there. This distinction between, on the one hand, a lifestyle focussed on fishing to support semi-retirement (with income still supplemented through additional skills and alternative strategies), and on the other, a drive to maximise profits, underscored the divergent development of social capital in Stilbaai and Mosselbaai and the corresponding different roles fulfilled for the fishers by professional and civic organisations.

With the choice of lifestyle over profits and the option to engage in alternative income strategies often not related to fishing, the maintenance of a strong formal linefishers' organisation was less of a priority amongst the Stilbaai fishers. Furthermore, with this semi-retirement and lifestyle focus, and use of alternative income strategies, the drive to maximise profits from fishing was diminished, making bonded collaboration and competitive pricing for fish less important objectives. This is not to say, however, that social capital was non-existent or unimportant amongst the Stilbaai fishers. Rather, the fishers sought alternative means of accumulating social capital by joining other organisations and associations that best suited their needs.

Voluntary membership does not require that individuals trust or be trusted by their fellow members (Newton 2001) and in the context of Stilbaai, a town comprised in the majority by retirees and affluent holidaymakers, voluntary organisations and civic bodies were many and varied, offering a range of options for fishers wishing to build or access social capital

without having to collaborate with their fellow fishers. Joining these networks and associations mobilised a combination of different forms of social capital, for example, to 'linking' social capital by exposing fishers, in principle, to retirees with links to powerful regional and national networks related to politics and law, thereby opening the possibilities of connecting seemingly disparate actors.

Considering the severity of challenges facing the linefishers, membership in a civic organisation might appear to be an insufficient support base to protect their rights and livelihood. However, in South Africa, civil organisations have acted as prominent political bodies giving voice to marginalised citizens since the 1980s (Seekings 1992; Maharaj 1996). Maharaj's (1996: 61) study on post-Apartheid social transformation, for example, found that "civic, community, ratepayers, and residents' associations (have) significantly informed national events". With a traditionally strong voice in their dealings with government, such civic groups thus provide political and economic representation for the fishers, offering an important facilitation service which allows them to sustain their lifestyle. Using these as a two-way channel via which to gather information and have their voice heard, the Stilbaai fishers built up social capital and expanded their networks outside of their fishery. Such mutable, tentative arrangements would be unsuitable in Mosselbaai given the overriding economic objective, but in Stilbaai, these civic organisations and networks represent the means to sustain multiple objectives and alternative livelihoods whilst maintaining one foot in the fishery for those times when fishing is worthwhile.

In an analysis of case studies on community governance interactions and social capital from around the world, Bowles and Gintis (2002) suggest that the importance of community responses (and thus social capital) will increase in the future as the failures of markets and states become more widespread and their repercussions more dire in the face of climate change and other pressures. Understanding the social interactions and networks that constitute social capital is thus key to understanding resilience in the face of change.

Conclusion

Social capital and trust lie at the heart of the success and failure of the southern Cape's formal linefishers' organisations. Yet the absence of a formal organisation does not indicate the absence of social capital. Rather, social capital was evident in different ways throughout

the fieldwork, mobilised in pursuit of various means ranging from friendship to maintenance of lifestyle, access to information, political representation, and pure economic gains. Despite the failure of the Stilbaai linefishers' formal representative organisation, the mobilisation of various alternative networks of association from membership of civic organisations to individual friendships served to 'fill the gap' and provide the fishers with some measure of representation and access to information which individuals are unable to achieve in isolation. In this way, whilst the findings reiterate the value of formal organisations in bolstering social capital and associated benefits for participants, but suggest that these are only one means by which linefishers gain to access sufficient social capital to maintain their livelihood. The accumulation of social capital then, represents both a process and goal by which southern Cape linefishers reduce their vulnerability and so bolster their resilience in the face of a multiple intersecting challenges in a shifting social-ecological system.

From the observations and field interviews, it becomes clearer that the various factors influencing social capital between the fishers – trust, leadership and lifestyle goals – have had a significant impact on the way the two linefishers' organisations functioned. In Stilbaai, the dominant focus on a lifestyle of semi-retirement and presence of multiple alternative associations with which to cultivate social capital, afforded fishers the option of not collaborating directly within an organisation. Moreover, with fishing forming only one of a suite of available income strategies in their skill set, representation in dealings with government and other fisheries were not as pressing as for those solely reliant on fishing income. Without the focus on financial gains espoused by their neighbours, the Stilbaai fishers had less incentive to work together to maximise income. The absence of a responsible, entrepreneurial leadership further exacerbated the situation; with no leadership to rally around, the organisation did not represent any perceived benefits to the fishers that they could not secure through alternative associations.

Conversely, in Mosselbaai the economic positioning of the town attracted entrepreneurial fishers whilst the presence of a competitive inshore trawl necessitated collaboration in order to maintain their livelihood. Here, despite the absence of goodwill trust, competence trust and confidence in a transformative, entrepreneurial and responsible leadership served to bolster 'bonding' social capital as well as providing members with the flexibility to engage

‘bridging’ social capital as and when it benefitted them. The story of the two organisations then, is one of a complex intersection of lifestyle goals, location, and the impact of trust and leadership on social capital.

The findings of the current research suggest that trust is multifaceted, taking various forms, from which fishers draw different combinations to create, seek membership in, and forge linkages between relationships and networks. Just as there are different forms of trust evidenced through the findings, so too are there different kinds of social capital mobilised within, across, and outside of the fishery. It is the ability to effectively engage in and navigate these networks which imbues fishers with the capacity to pursue their chosen lifestyle or accrue advantages over their peers and achieve resilience in the face of large-scale change.

Chapter Five: Branding commercial linefish: barriers and opportunities in the southern Cape

Introduction

Small-scale and traditional fishers have been identified as being amongst the most vulnerable groups of fisher folk (Neil et al. 2007; Béné 2009; Béné et al. 2010). In the southern Cape, declining stocks of target species (Winker et al. 2014) have placed traditional commercial linefishers in a position of vulnerability (Gammage 2015). Resource competition from the mechanised and well-funded local inshore trawl (Visser 2015), particularly by targeting the staple of the linefishery, Kob (Winker et al. 2014), further exacerbates this pressure whilst a cohort of local fish-buying middlemen compound the problem by controlling fish prices as well as access to infrastructure and important resources. In the face of such challenges, linefishers must adapt in order to secure their livelihoods. One possible means for such small-scale producers improve their adaptive capacity is to engage in collective action. Taking advantage of consumer trends favouring sustainable, traceable, and quality food products (Hinrichs 2000; Campbell et al. 2014; Bolton et al. 2016; Witter and Stoll 2017), the experiences of small-scale fishers' cooperatives in Europe (Verhaegen and Van Huylenbroeck 2001) and North and South America (Kitts and Edwards 2003; Devaux et al. 2009; Foley and McCay 2014), and similar efforts amongst small-scale agricultural producers in Africa (Barham and Chitemi 2009; Kaganzi et al. 2009) suggest that collectivisation may provide the fishers with a voice in their dealings with government around management objectives (Jentoft et al. 1998; Olsson et al. 2004; Gutiérrez et al. 2011; McCay et al. 2014). Furthermore, by fostering cooperation and improving profit-taking through the branding, marketing, and retailing of their own products (Stoll et al. 2015), collectivisation and associated marketing may also serve to improve product quality, pricing and access to markets (Chloupkova et al. 2003; Kitts and Edwards 2003; Ünal et al. 2009), whilst reducing costs to the producers (Verhaegen and Van Huylenbroeck 2001; Hellin et al. 2009; Markelova et al. 2009).

The Community Supported Fishery (CSF) model in particular has emerged within the past decade in Western Europe and North America as a means of addressing a range of challenges facing small-scale fishers, including improving marketing and income (Brinson et al. 2011; McClenachan et al. 2014; Stoll et al. 2015). During this time, recognition of the

importance of collectivisation in small-scale fisheries has also proliferated, with the majority of European Union member states, for example, opting to include 'producers' organisations' in legislation (Martin 2008) with a view towards supporting the marketing and sale of their products. Concomitant with this rise in popularity of community supported fisheries, interdisciplinary research projects such as CURRA have also begun to support the CSF-type approach to bolster local economies (Neis et al. 2014). The spread of such collectivisation and application in different contexts has resulted in a range of structures and implementations such that there is no single model of CSF (Bolton et al. 2016; Witter and Stoll 2017). Here Witter and Stoll (2017) suggest that it is perhaps more pertinent to talk of 'alternative seafood marketing programmes' that assume various forms but also embrace several key characteristics. These include: a shortened supply chain that looks to connect consumers more closely with the production or producers; the promotion of various social, economic, and environmental objectives; and, capitalising on consumer trends and growing awareness, a focus on local production, traceability and sustainability amongst others (Witter and Stoll 2017).

Alternative seafood marketing programmes bring several advantages for fishers. For instance, where upfront payments from customers are taken to secure a portion of the catch, fishers know in advance the level of demand, reducing the financial risk associated with market uncertainty (Campbell et al. 2014). These payments can also be used to cover costs and repairs (Stoll et al. 2015). In turn, this can lower transaction costs as fishers are not beholden to middlemen and do not need to cover the costs of freight required to access markets further afield (Brinson et al. 2011; Stoll et al. 2015). At the same time, consumers benefit by gaining access to seafood that is often more sustainably and/or locally harvested or displaying a degree of traceability (Brinson et al. 2011; Campbell et al. 2014). By offering such local species, the approach may also serve to decrease pressure on overexploited species whilst adding value to others that are traditionally underrepresented in the market (McClenachan et al. 2014). Further to this, many alternative marketing collectives emphasise face-to-face interactions between fishers and consumers and the sharing of information, resulting in greater community support of the fishers as well as stronger community identity (Brinson et al. 2011; Campbell et al. 2014; Stoll et al. 2015; Bolton et al. 2016). In this way, alternative marketing programmes can contribute towards the resilience

of fishers by providing the buffering support required to successfully navigate disturbance (Stoll et al. 2015).

Alternative seafood marketing programmes also bring their own challenges. Working around established middlemen, distribution and retail channels raises the risk of being excluded from their benefits in future (Witter and Stoll 2017), particularly if the programme is not successful (Brinson et al. 2011). This challenge is by no means a new one, nor constrained to the southern Cape, as the historical literature on British colonies such as Australia and Canada illustrates. A legacy of financial domination by those individuals and companies with access to credit, transport, and distribution networks, in particular, so-called 'truck systems' (Hilton 1960; Ommer 1989; Stevens 2001; Hallowell 2004) and merchant credit (Ommer 1990) highlights the role that these systems have played in both aiding and hindering market access for small-scale producers.

The more direct consumer-facing engagement that many adopt also requires strict adherence to hygiene standards, a potentially costly undertaking for fishers (Brinson et al. 2011; Witter and Stoll 2017). The seasonality and dynamic nature of fishing also means that supply is often unpredictable (Witter and Stoll 2017) although this challenge can be positively reframed to support notions of seasonal, localised supply (Campbell et al. 2014). Related to this, alternative programmes for marketing must, of necessity, appeal to a sufficiently large consumer base to support the enterprise (Campbell et al. 2014), and in this regard, educating consumers is key (Witter and Stoll 2017). However, such steps inherently take up additional time and resources which can place additional pressure on fishers.

In the South African linefishery, while collective fishing rights have been slated for implementation for some time (DAFF 2012; Sowman et al. 2014), alternative fish sales by collectives are at a nascent stage. The imminent implementation of the Policy for the Small Scale Fisheries (SSFP) will empower cooperatives formed by traditional fishers to harvest, process, and sell seafood (DAFF 2012). These cooperative fishing rights will likely compete with those of commercial linefishers (who hold individual rights), by granting the collective fishers access to a basket of species which overlaps with the traditional commercial linefish species basket.

In response to growing concerns overexploitation of linefish and other marine species, and the damaging impacts of bycatch practice in the South African trawling sectors, the World Wildlife Fund for Nature's (WWF) Sustainable Seafood Initiative (SASSI), was formed in recent years as a consumer-focussed project working with retailers and supermarkets to inform and steer consumers towards making better informed, sustainable purchasing decisions. SASSI categorises seafood per different fisheries via a 'traffic light' system with 'green' representing sustainably harvested species, 'orange' cautioning against purchase and 'red' pertaining to species considered to be from "unsustainable populations, (having) extreme environmental concerns, (lacking) appropriate management or illegal to buy or sell in SA" (SASSI 2018). As consumer awareness of the SASSI index spreads, the index thus holds the potential to steer retailers and consumers away from certain seafood species or fisheries including the linefishery.

This chapter presents the results of an attempt to co-develop a novel brand for handline-caught linefish in Mosselbaai informed by the experiences of international fishers' collectives and the unifying characteristics of CSFs (Bolton et al. 2016). The objectives of this chapter are twofold. Firstly, it describes the process of creating an alternative marketing and branding scheme, identifying the desired qualities of the linefish product with fishers, and then discussing initial challenges encountered before the branding could take place. Secondly, discussing the reformulation and adaptation of the branding exercise following the initial hurdles, the chapter identifies both further challenges and benefits associated with the process.

Methodology

Field sites

Fieldwork was conducted in the southern Cape towns of Stilbaai and Mosselbaai, both host to established commercial linefishing for over 100 years (Steyn 1996; Visser 2015). With a legacy of failed branding attempts in Stilbaai (discussed below), Mosselbaai offered a larger more affluent population. Furthermore, where Stilbaai's linefishing organisation had disbanded, Mosselbaai's had retained a committed membership who frequently collaborated with one another (see Chapter Four), further marking it an ideal site to explore the value of a brand for linefish. When the organisation's members expressed interest in

collaborating around branding, it was thus decided that the experiment would be based there.

Approach

The research was informed by a participatory action approach, working with linefishers to first identify challenges, needs, and opportunities on the ground (Brydon-Miller et al. 2003; Stokols 2006; Bradbury-Huang 2010) resulting in the collaborative co-creation of a branding strategy for the fishers' catch. Ethnographic participant observation formed the foundation of the fieldwork. This involved spending up to six months at a time in the field over a period of three years, with fishers as they went about their daily activities on land and at sea. Further to the observational data collection, twenty-eight semi-structured one-on-one interviews were conducted with fishers; ten in Stilbaai and eighteen in Mosselbaai focussing on the merits of linefishing, their ideas of how a brand should differentiate itself from others, and what they saw as the biggest challenges. In addition, a total of six group discussions were held - two in Stilbaai and the remainder in Mosselbaai - with between two and five fishers present in each in order to stimulate conversations around the branding of linefish and garner further ideas and feedback on the exercise. In mid-2017 and early 2018, a total of 16 interviews were conducted with customers at the Mosselbaai fishers' store focussing on topics such as seafood sustainability and their purchasing decisions. In gathering the background information provided below, nine open-ended interviews were conducted with fishers, business people and fish buyers. All interviews and conversations were conducted in Afrikaans and have been translated into English. All names have been anonymised in the text.

Background

In mid-2016, SASSI released its re-evaluation of several key linefish species. Included in this list was Silver Kabeljou (*Argyrosomus inodorus*) ('Kob'). The species which had traditionally formed the backbone of the southern Cape linefishery, Kob had previously been classified as green when caught by the linefishery but was now classified as red. Linefishers in the region have a longstanding relationship with middlemen – fish buyers closely affiliated with inshore trawling companies - who purchase linefish fresh and unprocessed on the quayside. As such, fish buyers represent the principal means through which linefish is purchased and marketed to consumers (Isaacs 2013). The inshore companies in turn sell a portion of their fish to

retail chains. With the linefishers' focal target species classified red, and prominent retail chains less willing to purchase orange- or red-listed species in light of a growing awareness of the SASSI classification, linefishers were caught between the need to catch fish but increasingly limited options for its sale, marketing and distribution.

A relationship of interdependence was established in the early 1930s in the southern Cape linefishery between linefishers and middlemen (Visser 2015) that continues into the present, motivated by the variety of fish caught by linefishers, which middlemen use to diversify trawlers' catches with high-value linefish species. Today, the trawlers and middlemen offer access to ice, cheap bait, government-subsidised fuel, and consumer markets through their established distribution networks, reinforcing this relationship of interdependence. This interdependence, however, has been skewed in favour of the trawling companies; with their access to infrastructure, capital, and transport networks, the companies and their middlemen have been able to exert financially dominant buying practices over the linefishery (Isaacs 2013; Duggan 2012). The presence of the middlemen thus continues to keep prices largely static with limited alternative options open to fishers, despite increasing input costs (Gammage et al. 2017).

In the early 2000s, a prevalence of shallow water Hake (*Merluccius capensis*) in the southern Cape saw fishers switching effort from Kob. Hake is South Africa's most popular fish export with approximately 55% of the trawl catch exported annually (SADSTIA 2017b). The European demand for "prime quality" export Hake (SADSTIA 2017a) positioned the handline industry – with its low-impact methods in which each fish is caught and handled individually - ideally to match export quality requirements and in so doing, exposed the linefishers to a range of mandatory hygiene protocols. Ratings from the South African Bureau of Standards (SABS) as well as the internationally Hazard Analysis and Critical Control Point (HACCP) system were put in place, the latter emphasising strict hygiene controls on identified steps along the production and processing networks (HACCPAlliance 2017). In addition, linefishers supplying trawling companies were obliged to conform to the National Regulator for Compulsory Specifications' (NRCS) guidelines for the storage and processing of fish at sea, requiring boats to carry ice to sea and submit to random hygiene tests of fishers, fish, boats, and equipment.

By late 2004, Hake catches began to decline and by the end of 2006 fishers were reporting no landings of the once abundant species, returning their focus to targeting Kob. The expense of compliance with HACCP, SABS, and NRCS placed financial strain on the fishers, a factor, along with the associated technical and time-demands, noted as one of the most significant impediments to compliance with certification standards (Mutersbaugh et al. 2005). A national inshore trawling company's focus on linefish for domestic consumption and concurrent suggestion that icing and hygiene protocols were not mandatory saw most Stilbaai fishers dropping these altogether. In Mosselbaai, however, the linefishers continued to apply HACCP-type protocols on their vessels, including carrying ice to sea, sourced from trawling companies on the quayside.

Observing the downturn in Hake landings, a retired businessman began to meet with representatives of the Stilbaai linefishing community in 2006. Plotting a sustainable, diversified business model that would create alternative income strategies for fishers, the plan focussed on tourism including whale watching, fishing charters, the establishment of a tourism centre on the quayside, a fish processing and retail centre for locally branded linefish, and an adjoining restaurant in the now-abandoned fish processing building. Despite two attempts and the support of the local ratepayers' and fishers' associations, the plan was, however, rejected by the Department of Public Works. Towards the end of 2010, two Stilbaai fishers sought to reinvigorate the business plan, focussing on processing and storage facilities on the quayside. Purchasing a cold storage freezer truck, the two set about securing rights from the Department of Agriculture Forestry and Fisheries (DAFF) to utilise an unused government-owned blast freezer. In a similar vein to the previous attempt, however, the request was declined by the State.

In 2014, a long-term visitor from Sweden proposed a cooperative buying system on the Stilbaai quayside. Seeing an opportunity to market the sustainable, eco-friendly nature of the linefishery, the visitor set about establishing a network of fishers to supply Kob, Yellowtail (*Seriola lalandi*) and other linefish species. Buying a small cold storage freezer truck, the would-be distributor set about sourcing markets in Somerset West and Cape Town. However, high fuel costs, declining catches, fluctuating fish prices and size classes, and the inconsistency of supply put an end to the venture within three months.

During this time, the Mosselbaai linefishers continued to supply the local inshore trawler buyers with linefish and utilised these middlemen to secure access to the inshore trawlers' government-subsidised fuel, as well as ice and bait. In 2008, one of the linefishers established a small seafood takeaway kiosk on the quayside in 2008 with a view towards selling a portion of his and fellow linefishers' catches, mostly as fried fish takeaways. With Hake a popular fish in fried takeaways in South Africa, the fisher turned to the trawler buyers to secure access to trawled Hake. Efforts to specifically brand and market their catch themselves, however, had not been undertaken by the time preliminary fieldwork began in 2014, with the fishers relying predominantly on middlemen and a reputation for high quality fish, icing, and hygiene maintained since the Hake bonanza. In Mosselbaai and Stilbaai, the same prominent inshore trawling company that supplied the kiosk with its Hake, also operated outlets offering sit-down meals, takeaways, as well as retailing fresh and frozen seafood products including linefish.

Results

In what follows, the results of fieldwork interviews are presented in several sections. The first of these details the formulation of the initial branding exercise intended to be rolled out from a linefisher-owned takeaway kiosk on the quayside. The branding would include themes such as public awareness, the decision to focus on branding a single species, and the fishers' notions of quality and sustainability in relation to competitors' offerings. The following section proceeds with a description of the initial attempt at branding and the challenges encountered including the role of inshore trawling companies and middlemen. Following this, the work discusses the subsequent adaptations employed by the fishers in response to the initial challenges, and the catalysing of a deeper commitment to the branding of linefish by some participants. This latter section elaborates on some of the earlier themes from the perspective of fishers and customers, as well as presenting findings around topics including traceability, public awareness, the unexpected role of SASSI, the value of scarcity, and the continuing role of middlemen.

Attributes of the brand

With landings of Kob in decline in the region since mid-2010 (Winker et al. 2014; Gammage et al. 2017), Mosselbaai linefishers had taken to targeting Silvers (*Argyrozona argyrozona*), intermittent catches of Yellowtail with only sporadic Kob landings. The Silvers and Yellowtail were sold mostly to middlemen from distant urban centres including Johannesburg and Durban. The bulk of the Kob catch was left for sale to the local market, being mostly bought by buyers affiliated to the locally-dominant trawler company. Kob is an important bycatch species for the inshore Hake and East Coast Sole (*Austroglossus pectoralis*) trawls (Winker et al. 2014). At the time that the branding exercise was formulated, it was recognised as a sustainably harvested species in the handline sector (SASSI 2017). Fetching relatively high prices on the quayside and considered the most profitable species in the linefishery (Winker et al. 2014), Kob thus represented an ideal species to create a brand around, and the fishers suggested that it should be the initial focus of the exercise. Participants agreed that Kob prices would be raised by R5 per kilogram above the going wholesale price, an increase of about 12%. A range of other linefish would also be sold from the kiosk but be kept at regular prices and fish would be sold whole or filleted at no extra cost.

Interviews with Mosselbaai fishers throughout 2014 and early 2015 suggested that they considered their strongest attributes in branding and marketing the catch to be the methods that inherently differentiated their approach from those of the inshore trawlers. The sustainable (as per SASSI assessment at the time) method employed in linefishing for Kob was one such factor. Following fisher and owner of the quayside takeaway kiosk in 2016:

> *The fact that we are catching fish so sustainably – and this is just the way we naturally do things anyway – that should be a big thing in the public's eyes. We target specific sizes – only this size and not bigger than that and so on – but the trawlers, they catch everything! So, the public must be made more aware. That's where the SASSI can be helpful for us and for the public to make an informed choice.* (Joe)

Speaking with fisher Paul in early 2015, the fisher reiterated Joe's sentiments, suggesting that public awareness could be influenced by campaigns such as the SASSI list:

> *…it's a question of making people more aware of the listing of different species but also for SASSI to work with the different (types of) fishers to understand what is sustainable and what isn't – they can really help us or (harm) us depending on what they say…* (Paul)

These interviews also highlighted the fishers' understandings of the interconnection of consumer awareness and marketing with purchasing habits.

Meetings with the fishers indicated an additional hallmark of their enterprise; the number of jobs created per the amount of fish caught, especially when compared to trawling. As fisher Robert commented in late 2015:

> *Look, you've got maybe six guys working on a (handline boat), neh? And that's the same number as works on a trawler. But the (handline boat) is taking out so much less fish. So, it's creating more jobs per tonne of fish caught if you can think of it like that, you see? …This sort of thing is important – (the public) doesn't know it but we are a job creator…But (the trawlers) use machines (to catch their fish), we use people. So, our quality is always good because we don't damage the fish. It is a hands-on process from beginning to end. Not many (fisheries) can say that.* (Robert)

The nature of the linefishing work was held by the fishers as contributing towards high quality products. In the interview above, for instance, Joe referenced a "hands-on process", adhering to a set of protocols that improved the quality of the catch, another distinguishing factor the fishers wished to focus on in their branding. In this regard, Mosselbaai fisher Paul commented in early 2016:

> *Because each (guy) has his position on the boat, and (they) work as a team…what that means though is each (guy) is focussing on his line, on his fish. So, when he brings it in, and he knows that quality means (the skipper, and thus in turn again the crew, will) get more for it at the harbour, then he takes care of it… Now if you're trying to market your fish to people, not just make fillets, that's what they want is that quality. If they know there's always quality there then they come back to you. And they don't mind a higher price maybe because they'll pay for the quality every time.* (Paul)

Further to this, differences in quality were also present within the linefishery itself. In a late 2016 conversation between Mosselbaai fisher Robert and Stilbaai fisher Jeff, the two fishers discussed the different prices fishers received for their catch resulting from divergent attitudes towards the use of ice on the boats:

> *Robert: …buyers will drive from Durban or (Johannesburg) and (Port Elizabeth) to us (in Mosselbaai) for good quality fish. They used to drive to Stilbaai but the Stilbaai guys didn't use ice on their Silvers so the buyer bought it, froze it and then realised it was already too late and it had rotted… Only Jeff used ice on his boat. And now we in Mosselbaai sell it for more than double what they get in Stilbaai - what do you get Jeff? R12, R14 rand a kilo?*
>
> *Jeff: For Silvers? Ja, R12 a kilo maximum. And that's me, with the ice – but there're no buyers here for it anymore so I can't get a better price.*
>
> *Robert: You see? We now get R28 a kilo. I have been working with (a buyer from Durban) now for 3 years and he is loyal to me, I am loyal to him. He knows he gets the top-quality fish from me and he is happy and he pays.*

Based on these and other conversations with the fishers, a clearer picture began to emerge of the attributes – high quality, low environmental impact, and better local job creation per quantity of catch – that they considered to be the most important in branding their catch.

Initial rollout and challenges

The start of the Easter holiday period of 2015 was selected for the roll-out of the linefishers' Kob brand. The design of the branding exercise was informed by the CSF approach, with the intention that fishers market their catch directly to the public. This would be done via the small quayside kiosk owned and operated by one of the fishers, to whom most of his colleagues already supplied surplus catch not purchased by middlemen. Advertising would be conducted around the kiosk via blackboard signage emphasising the qualities of job creation, sustainability, and quality, as well as by word of mouth by fishers utilising their local social networks.

A week before the launch of the campaign, however, pressure from local trawler middlemen forced the fishers to abandon the project in its originally planned form. A significant portion

of Kob linefish landings are purchased by the trawling company to supplement the trawl-caught Kob landings. In this way, middlemen mix linefish-caught and trawl-caught Kob together and sell it all as linefish-caught Kob, fetching a higher price. The notion of the linefishers processing, marketing their own fish, potentially reducing the trawler middlemen's access to cheap linefish-caught Kob posed a threat to this mixing arrangement. In particular, the middlemen and their employers felt uncomfortable with linefishers distinguishing their catch from trawled fish on the basis of quality and sustainability:

> *Ja well, they didn't like that (laughing). I think they feel threatened if the public finds out that the fish we're selling is better and the same price or maybe cheaper than (the trawlers) sell it to them through the (supermarkets)…* (*Robert*)

The result of this discomfort was a suggestion that direct competition over marketing on the quayside might threaten linefishers' access to subsidised diesel controlled by the inshore trawlers:

> *…it's simple - they didn't like that…then they talk about the diesel - we need that (subsidised) diesel and if we (upset the trawlers) then that puts us in a difficult position, you see? So now you have to move carefully…* (Robert)

The proximity of the kiosk on the quayside near the trawlers' base of operations was also felt to represent a further issue. Following the kiosk owner:

> *…but I can understand that we're right there, next door to them trying something different so it's a thing when they've got a big operation going and we step on their toes.* (Joe)

Adapting the approach

Whilst this initial result abruptly put a stop to the original branding exercise, the idea and interest it had garnered amongst the kiosk owner and the other fishers was slower to dissolve and began instead to evolve into a new scheme. Having been at the centre of the interactions with the middlemen, the kiosk owner suggested in an interview following the incident that, rather than putting him off the idea, the initial hurdle had confirmed that an effective local marketing space held profitable potential:

> *…so I reckon if the guys in such a big company are worried about us and our little things that we're doing, then we are actually doing something right. It shows me that this thing has hit a nerve… So that makes you- a person can see that it can work. And why shouldn't we be able to market our own fish especially when it is different from theirs?* (Joe)

The fisher felt that the branding effort could still work and went on to suggest that it was the nature of the location and premises that would determine its ultimate success:

> *…I can say, if we are so close, on the harbour - it's too close for comfort, right (laughs)? Being a bit further away in town where we're just another business, that's okay…* (Joe)

Working with fellow organisation members to secure access to a regular portion of their catches through a collective agreement, the owner closed the quayside kiosk and took steps towards opening a retail space away from the harbour. Facing high start-up costs, the fisher secured funding from a silent partner. By mid-2015 the fisher had opened a seafood retail store located in a small shopping park in the commercial centre of the town encompassing a takeaway, fresh and frozen seafood sales, as well as a storage and distribution facility. Where the conventional supply chain (Fig. 5.1) saw little of the linefish catch moving via the linefishers directly to consumers, the new approach (Fig. 5.2) represented a diversification of distribution and sales options for the linefishers by strengthening the shorter branch from fishers directly to consumers.

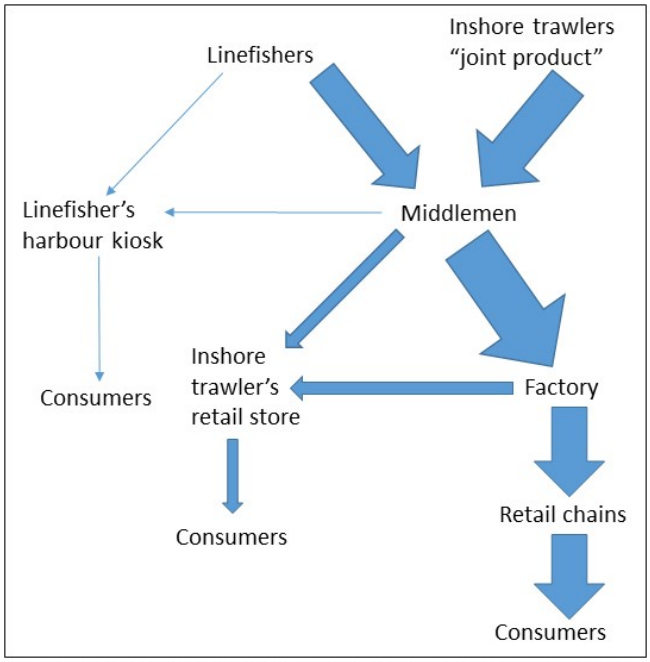

Fig. 5.1. Schematic of conventional linefish distribution in the southern Cape.

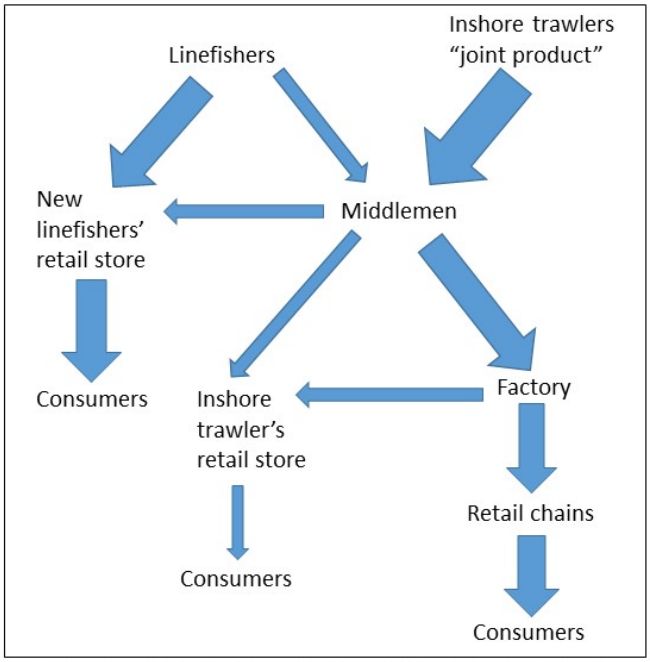

Fig. 5.2. Schematic of new Mosselbaai retail model. Note fishers buying supplementary fish from middlemen.

Rather than focussing on Kob as originally planned, owner and fellow organisation members now sought to brand their entire catch and way of fishing via the medium of the store. Where the original kiosk was a tiny prefabricated structure near the skiboat slipway, tucked away in the industrial quayside of the harbour, the new store was pitched as an upmarket offering in the heart of Mosselbaai's new central business district, with large display areas, bright lighting, and a broad array of high-end seafood products on offer including an assortment of fresh linefish as well as seafood imported from Southern Africa and Southeast Asia such as prawns and shrimp. This position, aesthetic and variety appealed to consumers:

> *Yes, we like the store – I know it was on the waterfront there before but we didn't go – this one now is clean and everything you can see is fresh…for me, I like to pop in on a Friday for my fresh fish and my husband loves those (frozen) prawns* (Customer 6/18/7)

Where the old quayside kiosk had focussed on retailing low-price fried fish (Kob, Yellowtail and Hake) and Squid takeaways, the new store opened with a different focus, reframing linefish from a cheap protein source to an upmarket product. As the store's customer base rapidly grew, however, consumers demanded a wider range of species in addition to linefish. In a bid to appease these customers and entice a more affluent clientele, the shop began to increasingly operate in the style of a boutique seafood store. As an example of

this, the store owner began to mobilise relationships with outside suppliers in a bid to secure consistent supply of frozen seafood delicacies including several species of prawn, West Coast rock lobster (*Jasus lalandii*) and South Coast rock lobster (*Palinurus gilchristi*). In so doing, the store's offerings began to reflect a global shift in preference amongst middleclass consumers towards high-end and high-quality produce (Verhaegen and Van Huylenbroeck 2001; Campbell et al. 2014).

The new shop also opened better opportunities for the fishers to interact directly with customers, providing an opportunity to inform them of the distinction between linefishing methods and those of the trawlers, for example. As such, the retail space become a hub for the linefishers to tell their story to the public and spread their own products. Following an interview with one of the linefishers supplying the store in early 2016:

> *It's cool to see how people line up when we bring (a catch) in at the store – and we can educate them…at the old place they didn't really know who was supplying the fish but now it's clear for them…so…(the consumer) gets to talk to the actual fisherman…then they understand more about what we're going through and they want to support us.* (Paul)

The interview above also revealed the value of traceability that the store offered. By linking fishers directly to their customers through face-to-face interactions in the store, customers gained insight into where, when, and how the linefish was caught:

> *For me it is so nice to come here – to buy straight from the boats almost (laughs). I know (Robert) for a long time now and we know some of the other (fishers). So, we trust them I can say. It's for me – it's important to know who is catching my food. We eat so much (unhealthy food) nowadays from (the supermarkets).* (Customer 3/18/7)

Following another of the customers, traceability was bolstered by the possibility of engaging directly with the fishers rather than buying through a large retail chain:

> *…I like to buy my (linefish) here because I know it's fresh and not frozen. I can talk to the fisherman directly – where else offers that? If you buy it in a (large retailer) they lie! They'll tell you it's from here, but it's actually imported then unfrozen! With the*

> *(store) here now, we can come and have a chat and know who caught this fish and tell straight away it's fresh and perfect.* (Customer 2/18/7)

Along with traceability, assumed sustainable practices were also important drivers in consumers' support of the store. Speaking with two customers at the store about the SASSI status of various linefish species, the first commented:

> *I've been eating Kob from (Mosselbaai) my whole life. I'm not going to stop now because SASSI says I must – look, the trawlers, everyone knows, were hurting the Kob …But I will always eat local Kob that's caught on a handline boat – you cannot tell me they devastate the stocks like a trawler does. I've fished off here (recreationally) for years and I've seen the difference with my own eyes – night and day. To me, that's sustainable.* (Customer 4/18/7)

Similarly, the second respondent contended that, despite the most recent SASSI listing, the methods employed by linefishers were sustainable compared to the inshore trawlers and motivated her decision to continue to purchase local linefish:

> *…I don't eat fish all the time but if I do, and I want to feed my family, I come (to the shop) because…the way it's caught is still ecological. That SASSI list says that some fish is not sustainable. I can agree with that, but then you must look at how (the linefishers) catch fish and how a trawler does it. (The trawlers) scoop it up and damage the sea floor. But a handline? One little line catching a few fish out of a shoal?* (Customer 1/18/7)

In addition, interviews with fishers in mid-2017 indicated that what had initially appeared to be a blow to their industry – the SASSI reclassification of several key linefish species (including Kob) as 'orange' or 'red' in early 2016 - had in fact played in their favour with the store now perfectly positioned to capitalise on a changing tide of consumer awareness and behaviour against trawled fish. As supermarkets began to remove certain species from their shelves, the growing base of middleclass consumers in Mosselbaai, seeking fresh linefish and being able to afford it, now turned to alternative sources with the shop becoming a focal point:

> *We always thought SASSI can harm our business. I think it still could actually. But we see now people coming in and they tell us they want such and such a fish but the (supermarket) (doesn't) stock it because they say its bad (according to) SASSI.* (Robert)

For some species, the fishers had learnt that inconsistency was something prized by customers of the store. Discussing the sale of Gurnard (Cape gurnard, *Chelidonichthys capensis*), during the same interview, the fisher suggested:

> *You know, it's weird – the people want to know there's Kob but with a thing like the Gurnard – that fish they prize hey – they don't complain when it's not in, the one lady told me she sees it like a special treat because it's so delicious…so I think for some types of fish, people want it now, every day. And then for others, they like that it is rare and they wait…now we can work with that – it's part of the pull of this (store) – the people know then that they won't get something all the time so they know it's fresh and it was caught here.* (Robert)

This sentiment was echoed by a customer in an interview in mid-2017:

> *You get (Gurnard) in hardly any other places, you understand - some other people here complain that they don't always have the fish they want but that's the point – it's fresh – if you want Yellowtail or Kob all year round then you must know that it's frozen!* (Customer 3/18/7)

This combination of notions of limited availability, quality and local traceability of linefish enabled the store to retail its linefish for prices 10-25% higher than possible on the quayside, depending on the species. Despite these higher prices, consumers appeared content to pay for perceived quality:

> *It's sometimes more (expensive) than the (supermarket), yes. Sometimes it's not. But then this is fresh fish – you can watch them bringing it in on the harbour if you want to – no (retail chain) can let you do that! …so, to me that's worth every penny…and if they don't have what I want, or enough of it say, then I always but some extras like a (frozen) Snoek.* (Customer 1/18/7)

Another of the store's customers suggested that expense was of less interest in her purchasing decision than availability of preferred species:

> *…yes, it's probably more expensive here than (supermarket chain), but they don't stock the fish I want – you'll never find Gurnard at (supermarket)!* (Customer 7/18/7)

Follow-up interviews with customers in late 2017 also indicated that those who purchased rare or unsustainably exploited species were not interested in their sustainability status. In reply to a question about the sustainability status of West Coast Rock Lobster, a purchaser replied:

> *…agh no, I don't keep track. I know it's hard to get (rock lobster) but my family's here for holiday – I'm just glad they have (rock lobster) here – ok look, I hardly ever buy this stuff, we usually eat prawns and that so no, I don't think it's bad to buy it now and then.*

Asked if purchasing price affected his behaviour, the customer replied:

> *No look, it's a treat sort of thing, right? I don't look at the price really, maybe to know how much per kilo but, how can I say, if it's crazy maybe, but (rock lobster) is expensive so if you come here to buy it, you're not going to worry over this or that difference (in price)* (Customer 2/7/8)

Another customer remarked that the availability of rock lobster suggested that it was not threatened:

> *How can you tell me it's rare or whatever? There's a whole freezer of it my friend. This is not poached, it's on display in a shop. If it's for sale then it's meant to be bought, you understand me?* (Customer 4/7/8)

Facing increasing demand for diversity from customers, the linefish store owner turned to the middlemen to supplement stock with an assortment of trawled species such as Hake, Squid, Kingklip (*Genypterus capensis*) as well as imported seafood products. This move to maintain old connections of trade between the linefishers and middlemen served to appease the latter somewhat, sustaining the relationship through which the linefishers secured access to ice, bait, and subsidised diesel, as well as mitigating against variable

supply in times of limited availability of Kob and other linefish species. Following an interview with the store owner in mid-2017:

> *…so now sometimes we must use the trawlers, get a little fish from them…so I must tell the customers because a lot of them will ask so it's best to tell them straight away "yes, it's fresh but it's from the trawlers". I think we've all been here so long working we need each other now…so (the middleman) likes it more now if we can buy some fish from them and he can buy some Kob from us and for us to have stuff like Kingklip and Squid that we don't normally catch but the people want is good for bringing customers in.* (Joe)

However, this continued relationship of interdependence between the linefishers and the inshore trawl also provided the trawler middlemen with an additional outlet for their products. In other words, whilst the initial intention of the linefishers' store was to sell mostly locally-sourced linefish and seafood products, increasingly it served a dual role in selling fresh linefish in combination with a range of the trawler's products. As the store grew, its offerings were increasingly skewed towards exotic, scarce, and imported species and by mid-2017 on a follow-up visit, it was observed that, whilst linefish was still a focus of the store's marketing efforts, the majority of products offered were no longer fresh linefish, but rather frozen products which included West Coast and South Coast rock lobster, an assortment of imported frozen prawns and shrimp, and Norwegian Salmon, many of which are listed as orange or red by the SASSI index.

Discussion

The branding attempt was originally formulated through the feedback and input of the local linefishers to display several central characteristics of the alternative seafood marketing approach including local sourcing and traceability of products, a shortened supply chain, and engagement with consumers (Bolton et al. 2016; Witter and Stoll 2017).

In a study of CSFs in North America, Brinson et al. (2011) suggested that traceability, the ability of consumers to readily verify the origins or provenance of a product, provides insight into and a connection with the harvesting process from which they would normally be disconnected. In the store, as far as fresh linefish were concerned, the face-to-face interactions between fishers and customers provided a means of framing traceability,

enabling customers to speak with those responsible for catching the fish, spreading and reinforcing awareness of the fishery's unique characteristics. This process of engagement between fishers and consumers facilitates the sharing of information (Bolton et al. 2016). Information sharing can take many forms and be as simple as fishers informing customers as to where a particular species was caught, but is nonetheless a marked difference from the separation of the customer from the fishing process that typifies conventional seafood retail (Bolton et al. 2016). In this way, the store became a space in which to have a conversation about a changing fishery through which the fishers sought to brand their livelihood and reframe notions of low abundance (of Kob and Gurnard, for example) or seasonal availability (of Yellowtail), by educating customers on issues of seasonality and traceability, in so doing, reframing scarcity as an indicator of quality.

Where the conventional supply chain for linefish (Fig. 5.1) saw linefishers almost completely disconnected from the consumer, the retail store saw a much closer connection established (Fig. 5.2), at least where linefish sales were concerned. The shortened supply chain thus connected fishers more directly with consumers, fostering "meaningful connections" between these groups (Bolton et al. 2016: 23). Being able to interact with the linefishers, or at least the possibility for customers to know that the fish was caught by these local fishers through these engagements and the shortened supply chain can also foster trust in the enterprise (Brinson et al. 2011; Campbell et al. 2014; Stoll et al. 2015; Bolton et al. 2016) as suggested in customer interviews.

The successful operation of the store was also aided in part by an unexpected source. Where fisher Paul expressed his concerns regarding the influence of SASSI on the linefish sector, in Mosselbaai the SASSI classification proved to have benefitted the linefishers' branding efforts. Through SASSI's listing of popular linefish as orange or red, those retail chains that adhered to the SASSI index had been compelled to limit or cut supply of these species. Instead of ceasing their consumption of these species, however, customers turned towards niche seafood stores such as those run by the linefishers and the inshore trawlers. Here, existing consumer awareness of linefishing methods benefited the linefishers, with customers expressing a preference for linefish species such as Kob and Gurnard, despite the cautionary messaging of SASSI.

Entrepreneurial leadership represented an additional driving force in the successful launch and operation of the store, in this case represented by the store owner and chairman of the Mosselbaai linefishers' organisation. Entrepreneurial leaders have been shown to strengthen bonds amongst members of their organisations and in so doing imbue the organisation with improved capacity to adapt or transform in the face of change (Purdue 2001; Gutiérrez et al. 2011). In this way, the entrepreneurial capacity of the two leaders was instrumental in securing funding investment to open the store, broker supply deals with middlemen, and ensure that members of their organisation regularly supplied the store with fresh linefish.

As the store grew, an increasing amount of frozen seafood products were sourced through the middlemen. Over time this diversification of offerings not locally (and in some cases not domestically) sourced diluted the traceability of many products for customers, undermining the linefishers' initial desire to build their brand on traceable, locally caught linefish products. Thus whilst diversification of offerings in North American alternative seafood marketing collectives has been shown to decrease pressure on threatened or over-harvested species whilst adding value to alternative, under-valued and abundant species (McClenachan et al. 2014), in the case of the southern Cape, the constant influence of the inshore trawl represents an ongoing threat whereby diversification of products represents the possibility of entering unsustainably harvested species into the offering.

Despite the loss of traceability and local supply for many of the new seafood products, linefish's specific links to local fishers remained, serving a new purpose. By expressing the virtue of locally traceable linefish, the shop and its entire offering by extension became associated with notions of sustainability as reflected in the earlier interviews with customers. Here notions of traceability, quality, local sourcing, and sustainability became somewhat conflated allowing customers to buy the variety of non-sustainable seafood products on offer without concerns over sustainability status. As an example of this, one customer questioned the sustainability status of rock lobster given their prevalence in the store. As a further example, with Kob having been reclassified by SASSI as an unsustainably harvested species in both the handline and inshore trawl sectors in mid-2016, customers of the store interviewed after the reclassification continued to buy handline-caught Kob.

These results support the findings of previous research into South African seafood consumer's buying patterns in relation to the SASSI index, which suggested that for those scarce species classified into orange or red categories, such as (currently) Kob and rock lobster, quality and freshness were held in high esteem by consumers, with price and sustainability of less importance in the purchasing decisions (Landey 2013). This prioritisation of other factors over sustainability concerns has also been observed internationally with a recent study of retail store customers in Canada finding similarly that these respondents placed more importance on other perceived aspects of seafood (such as health benefits) than concerns about sustainability (Murray et al. 2017).

The results of the fieldwork also support Landey's (2013) findings that the same consumers for whom price was not a concern also represented the majority of those who were aware of the SASSI index, expressed knowledge of sustainability issues, but were the most likely to purchase orange-listed species. These observations thus suggest a reason for customers of the linefisher's store demonstrating a willingness to purchase products which were not SASSI green-listed; catering to a more affluent customer base, the store attracted consumers for whom freshness and quality were of principal concern, and who sought exotic and scarce seafood with little concern for its price or sustainability status. Where one of the interviewed customers prioritised availability of rare species over cost, for example, another suggested that price was not something worth keeping track of when purchasing species considered a "treat", and another queried whether rock lobster was indeed a threatened species given its ample availability in the store, suggesting further that its offer for sale suggested that it was "meant to be bought".

This is not to say that all customers of the store did not prioritise sustainability. However, for those who did, notions of sustainability were tied to the linefishers' methods and its locally-sourced nature, echoing Murray et al.'s (2017) suggestion that consumers might conflate sustainability with the location or means by which seafood is produced. Providing consumers with lesser known, sustainably harvested species might address this challenge. However, offering consumers an assortment of fish they are not usually exposed to, is also a potential stumbling block for fishers' collectives (Bolton et al. 2016). As such, steps in this direction will need to be taken slowly and carefully, and with appropriately formulated marketing.

The consumer desire for orange- and red-listed species suggests that whilst affluent South African seafood consumers prioritise freshness and quality, there is a dire need for actual buy-in to sustainability thinking. Limiting the store's offerings to only locally-sourced linefish, for example, would have attracted a smaller customer base. Thus, the desires of store's consumers, driven from supermarket chains in search of exotic and scarce species, coupled with the fishers' financial liabilities, necessitated a diversity of seafood offerings to sustain the store. In this sense, acting as a collective to only sell linefish would have exposed the linefishers to too many risks. To sustain an economically viable linefish store without offering orange- and red-listed species, consumer attitudes and demands will thus need to change.

The investment capital from an outside funder required to establish the retail outlet speaks to the high start-up and transaction costs associated with an attempt to operate independently from the capital available through established channels such as offered by trawler companies. The necessity of sourcing outside funding supports Brinson et al.'s (2011) observations that high start-up costs including investment in infrastructure and training of participants may hamper CSFs development. In a study of CSFs along the East Coast of the USA, Brinson et al. (2011) identified the potentially high costs associated with establishing a CSF including marketing, processing, and distribution as a considerable impediment to fishers' efforts. Additional costs include investment in refrigeration and storage, as well as the upskilling to run the business (Brinson et al. 2011). Whilst the move towards collective marketing action is undoubtedly positive for many groups, work with South American farmer's collectives suggests that realistic evaluation of prospective transaction costs is essential from the outset (Hellin et al. 2009). Where taking a product to market as an individual can be associated with low transaction costs, joining a collective may at times drive these up through various costs such as membership fees and monthly contributions (Hellin et al. 2009). The counterpoint to this is that products with already high individual transaction costs can benefit tremendously from collective action, including pooling resources and spreading costs over a greater number of contributors as is demonstrated by the Mosselbaai fishers' store with its multiple ownership.

In the South African context, though a version of the CSA approach has steadily gained in popularity in the metropolitan centres in the past decade and some small independent fish

retailers do exist, the majority of fish is still sold through large supermarket chains. An alternative seafood marketing programme requires a great deal of trust-building between fishers and consumers willing to engage in the model and the idea of consumers paying in advance for food products, not being established in the country, would require a considerable shift in consumer purchasing habits. There is some hope for the future, however. Recent trials of *Abalobi* (http://abalobi.info/), a mobile phone application project lead by Dr. Serge Raemaekers from the University of Cape Town, have begun to address the challenge of middlemen by connecting small-scale fishers directly with consumers. Although this project focusses on traditional fishers from poor communities, the innovation of direct contact between fishers and consumers, and the success from the pilot phase of the project suggest that it is possible for commercial linefishers to operate without the controlling influence of the middlemen.

The dominance of middlemen is well established in the southern Cape linefishery, with Stilbaai linefishers described as being "totally at the mercy of their buyers" as early as the 1930s (Visser 2015: 16). This situation in which powerful middlemen exercise economic and other controls over small-scale fishers is by no means unique to the southern Cape and has been documented in Southeast Asia (Merlin 1989; Ruddle 2011), East Africa (Crona et al. (2010) and South America (Pedroza 2013). As in these locations, the economic dominance of middlemen, whilst facilitating transactions and market access for fishers on the one hand, may also serve to impede the potential of the sector. By offering more direct access to consumers and an initial decreased reliance on the middlemen as the sole means of selling their catch, the store's establishment appeared to offer an opportunity to ease the influence of the middlemen. However, this by no means suggests that the hold and power of the middlemen was broken. Following the initial branding attempt's focus on distinguishing linefish from trawler-supplied products, and its subsequent failure for this reason, the retail store did not explicitly deploy the CSF or a similar label to describe its operations, a characteristic common to fishers' alternative marketing collectives (Bolton et al. 2016). With middlemen and trawling companies relying on handline-caught linefish species for variety, and the linefishers relying on these networks for access to critical resources (e.g. bait, ice, and fuel), the prospect of linefishers marketing their fish themselves, and explicitly differentiating it from trawl-caught fish represented a destabilising force which could

disrupt 'business as usual'. The field observations here also echo Witter and Stoll's (2017) suggestions that fishers deciding to self-market and retail their catch risk large companies prohibiting them from accessing such infrastructure and networks, and Brinson et al.'s (2011) similar contention that a shift away from traditional sales and distribution risks alienating important access and distribution channels, with potentially detrimental consequences, particularly if the collective is not successful in its own sales or distribution efforts.

As such, the linefishers had been unwilling to openly label their operation as an exclusive linefish store for fear of recrimination and loss of access to resources, but also out of a need to avoid being cut off from their established distribution channels via the middlemen. The store's increasing reliance on the middlemen for trawled and exotic species as it grew further evidenced the hold that middlemen continue to exert over the linefishers. To some extent, however, this economic relationship of mutual dependence also served as an important means of figuring out and establishing complimentary, rather than strictly competing niches.

Conclusion

The story of resistance and/or adaptation in the face of power was a prominent theme throughout the research presented in this Chapter. Where the chapter described the process of creating an alternative marketing scheme for linefish on the quayside, the notion of linefishers publicly distinguishing their catch brought to the surface the power dynamic inherent in this relationship of interdependence.

The store brought with it several benefits, enabling the fishers to establish complementary rather than competitive niches. This move towards not directly competing with or alienating the trawlers was key to its continued successful operation. The store also acted as a space in which fishers could talk with consumers, spreading awareness of their livelihood, challenges, and the perceived positive aspects of linefishing. The SASSI classification played an unanticipated role in pushing customers from supermarket chains to the fishers' store as a result of its offer of species that the supermarkets could no longer stock. However, with this growing customer base and their desire for exotic products, the original intention of the branding exercise to focus on the quality and sustainability aspects of linefish was

overshadowed by the store's need for profits, and an assortment of seafood appeased consumer demand but also introduced several rare and sometimes even unsustainably exploited species.

Despite the benefits of the linefishers' store in its adapted form, the continued presence of the trawlers and middlemen suggest that further work needs to be done with regard to breaking the chains of interdependence. In order to appease the middlemen, the fisher and his colleagues continued to supply some linefish to the trawling companies, as well as buying supplementary stock of seafood for the store. In so doing, the continued influence of the trawlers and middlemen in the store observed through the fieldwork suggested here that the fishers' adaptive step was once more limited by the dynamics of power at play in the fishery. Thus, although the original intention of the exercise was to ease the relationship of dominance for the linefishers, and whilst the store went some way towards improving their profits, the status quo remained largely unchanged.

Chapter Six: Synthesis and Conclusions

Recent critiques of SES thinking suggest that in practice social considerations and aspects of resilience thinking are under-researched (Wise et al. 2014; Olsson et al. 2015). Citing a study of over 550 journal articles, for example, Wise et al. (2014) found that just 3% of the articles focussed on social aspects of vulnerability, a key concept in resilience thinking in social-ecological systems. Further to this, whilst a large body of literature discusses vulnerability assessments, conceptual and theoretical developments, and the spread of knowledge and awareness, there is very little evidence of real-world implementation of these developments (Béné et al. 2011; Wise et al. 2014).

Although considerable progress has been achieved by the Resilience Alliance, for example, in bringing together researchers of different backgrounds and expertise, some social scientists continue to struggle to work within the social-ecological framework (Olsson et al. 2015). The reasons for this include a disconnect between the natural science-biased language and roots of concepts such as resilience, and the coterminous lack of attention within the SES framework to integral concepts in social science such as knowledge, power, trust, agency and conflict (Olsson et al. 2015). Disciplinary power dynamics can also play a role if researchers from different fields struggle to integrate their work into inter- and/or transdisciplinary projects (e.g. Ommer 2007; Starfield and Jarre 2011). In addressing these concerns, the thesis has sought to contribute to the challenge of understanding and working productively within a social-ecological system from a social science perspective by focussing on processes of social interaction, trust, participation, and learning.

A key precept of SES thinking is an adherence to interdisiplinary research, integrating different theories and methodologies in understanding the complexities of social-ecological systems and addressing research questions aiming at solutions to current problems (Ommer et al. 2007; Binder et al. 2013). Given the dynamic, unpredictable nature of social-ecological systems in general, and small-scale fisheries in particular, the use of multiple bodies of knowledge, theory, and practice served to address different elements of the research from various angles. The second contribution this work makes is thus in describing the practical unification of a broad range of concepts, theories, and approaches which are not conventionally brought together in a joint framework. These include participatory action

research, co-development, ethnography, social learning, integrated curriculum design, a social capital perspective, and branding. Thirdly, the work describes and evaluates the process of turning observational data and theory into several practical interventions which in turn serve to open conversations with people around social-ecological challenges. It has achieved this through a series of co-development exercises resulting in a water temperature sampler device, a series of integrated teaching modules for high school grades 7-9, and by way of a linefish branding exercise.

Research themes

Four themes were evident at different points in the fieldwork and in varying combinations in the chapters (Fig. 6.1). These themes were: social capital and trust; social and situated learning; resilience and transformation; and participatory action research and co-development. As an example, notions of trust were apparent in both the water temperature sampling exercise and the observations of the linefishers' organisations, however the ways in which trust was important, and the scenarios in which it played out, were markedly different.

	Chapter two: water sampler	*Chapter three: integrated teaching modules*	*Chapter four: fishers' organisations*	*Chapter five: branding linefish*
Social capital and trust	√	√	√	√
Social & situated learning	√	√	X	X
Resilience and transformation	X	√	√	√
Participatory action research & co-development	√	√	X	√

Table 6.1 Distribution of themes by chapter.

Theme one: Social capital and trust

Even though trust and the associated concept of social capital are highly dynamic, unpredictable, difficult to measure, and manifesting in various forms (Newton 2001; Putnam

2001; Newton and Zmerli 2011), the findings of the research suggest that they are amongst the most crucial factors shaping the future of the southern Cape linefishery. Facing mounting social, economic, political, and ecological challenges, the need for linefishers to work together is a pressing one. Without adequate social capital, however, the capacity for collective action, innovation and the exploitation of opportunities are greatly diminished and with them, the capacity to adapt (Pelling and High 2005; Nelson 2010).

It would be difficult and unnecessary, in the case of the current work, to accurately measure the level of trust between participants. Rather, it is suggested that there is value in focussing on the dominant form(s) of trust at work in the field sites, observing how these inform interactions, shaping decisions and changes in social capital and cooperation. It should be noted that the presence of one form of trust by no means suggests the absence of another.

Armitage et al. (2017: 255) suggest that "deliberate and informed participation" including collaborative, participatory processes, are key conditions for transformation by contributing towards the building of social capital and collaborative partnerships. The findings of this thesis suggest that in the context of the southern Cape linefishery, however, whilst participation may increase social capital, it is trust and social capital first, rather, which form the foundation upon which participatory and collaborative processes can be established. In other words, without a base of pre-existing trust and social capital, collaboration and participation are less likely to flourish.

Various forms of trust and social capital were expressed in different ways throughout the fieldwork. In the marine water temperature measuring fieldwork, trust was a particularly prominent but challenging factor. An ongoing legacy of marginalisation by government and those felt to be associated with government contributed towards a situation in which fishers were mistrustful of researchers as people they saw as tied to or influencing policy or regulation. Under such conditions, and as a methodological resource, involving people early and deeply can build trust and open further opportunities for collaboration (Fliess and Becker 2006). However, in the case of the water temperature measuring exercise, involving fishers as lead users in a co-development process proved insufficient to ensure collaboration. In this scenario, fishers' mistrust of outsiders played a part, with fisher Paul, for example, unwilling to allow a research scientist on-board his vessel and his persistent reluctance to share precise GPS coordinates. This speaks to the importance of building

'linking' social capital between different groups before collaboration can take place (Grafton 2005). That is, whilst the ethnographic participant observation had served to build trust between this researcher and the fishers, this did not result in the generation of 'linking' social capital beyond the field sites and thus could not extend beyond the immediate context to encompass other researchers.

In the integrated teaching modules work by contrast, ethnography and the co-development process served to build a foundation of trust between the researcher and students and teachers. Further, in a broader community context of mistrust, Vermaaklikheid School served a crucial role as a trusted centre of knowledge dissemination in the community. As the centre of learning and knowledge dissemination in the community, the school had built up a reputation as a safe and trusted space and with this had generated 'bonding' social capital within its community. This social 'glue' (Scrivens and Smith 2013) in turn enabled students to speak with community members where attempts at facilitating social learning by researchers would outright have met with suspicion. In this way, the findings suggest that the bonded networks engendered via the school represent efficient means of spreading information in places where such conversations are otherwise 'stuck'. Moreover, the 'bonding' social capital exerted by the school also served to lay the foundation for the further generation of 'linking' social capital (Grafton 2005). This was evidenced through the school's role as a trusted intermediary space, offering a link via which to engage the community. This link in turn facilitated further engagements by stimulating the latter's interest in discussing climate- and fishing-related issues in greater detail.

Where the fishers' organisations were concerned, this element of the research most explicitly showed evidence of the role that various forms and facets of trust and social capital play in the southern Cape linefishery. In Stilbaai, the breakdown of 'bonding' social capital, competence trust, and goodwill trust amongst the fishers contributed to the dissolution of their official organisation and repeated failed attempts to brand their catch. By comparison, with declining fish stocks, competition from trawlers, financially controlling buying practices on the quayside, and comparatively large distances to the fishing grounds placing southern Cape linefishers in a vulnerable position, the strong competence trust between Mosselbaai fishers manifested in 'bonding' and 'bridging' social capital. This in turn resulted in a strong organisation and internal collaboration, imbuing members with the

capacity to adapt to and work with change advantageously compared with their Stilbaai neighbours. Here the observations of the fieldwork are at odds with Newton's (2001) assertion that trust between individuals has little bearing on their decision to join or leave organisations by suggesting that, in the case of the southern Cape linefishers' organisations at least, trust and social capital indeed influence membership and participation. Further, the role of social capital in shaping the success and state of membership in both towns' linefishers' organisations strongly resonates with Gutiérrez et al.'s (2011) findings that strong social capital is a hallmark of successful fisheries.

Beyond the strong 'bonding' social capital observed in Mosselbaai which sustained collaborations between its members, 'bridging' social capital was also evident in the collaborations between Mosselbaai and Stilbaai skippers. This 'bridging' social capital was founded on the Stilbaai skippers' competence trust in the Mosselbaai skippers such that they trusted in their ability to guide them to productive reefs. Through these collaborations the advantages that 'bridging' social capital and competence trust afford participants - in particular the knowledge sharing that this brings about - become clearer (Grafton 2005; Maak 2007).

In the Mosselbaai exercise to rebrand Kob catches, evidence of trust and social capital were again shown in different ways. In the initial stage of the branding exercise, where the work looked to differentiate handline-caught linefish from trawler-caught and thus reduce the linefishers' dependence on middlemen, the 'bridging' social capital between fishers and middlemen was threatened. This scenario exposed the stabilising role that 'bridging' social capital plays in fisheries (Grafton 2005); although built on a relationship of inequitable interdependence, the threat of diminished 'bridging' social capital raised by the branding exercise on the quayside threatened to destabilise important infrastructure access for the linefishers.

Further to 'bridging' social capital, the 'bonding' social capital that underpinned the Mosselbaai organisation played an important role in the adaptation of the branding exercise, helping to secure a regular supply of members' catch to the store. Here, the observations are at odds with Knack and Keefer's (1997) contention that membership of a formal organisation is not associated with improvements in individual's economic prospects. In the case of the thesis observations, the success of the Mosselbaai linefishers when

compared with their Stilbaai counterparts suggests specifically that whilst membership of organisations unrelated to fishing might well not yield economic benefits (although other benefits may result such as access to information and representation), in the southern Cape at least, membership in a formal linefishers' organisation with a focus on collaboration and profit-making, and the 'bonding' social capital this creates, can indeed financially benefit members. In this instance then, social capital results in an economic advantage.

In their study of co-managed fisheries, Gutiérrez et al. (2011) found that strong local leadership was crucial in building and sustaining social capital. Strong, competent leaders who look to expand their networks and add value to members' lives (be it socially or financially) in turn build stronger social capital within the group (Maak 2007), as evidenced in the Mosselbaai organisation. In the observations of the fishers' formal organisations, transformational leadership (Purdue 2001) in particular was a crucial characteristic influencing membership, evidenced in the Mosselbaai leadership's decision to change vessel type, fishing grounds, and target species, as well as their willingness to explore new retail channels via the branding exercise. This ability of the leadership to enact transformative policies also highlighted the entrepreneurial, creative problem-solving, competitive and collaborative characteristics of a successful transformational leadership (Purdue 2001).

Social capital was also important in establishing and expanding links to consumer networks, as well as securing buy-in amongst fishers to supply the store. Without the commitment amongst the fishers to provide a portion of their catch to the store, its opening would likely have faced the same fate as previous failed efforts in Stilbaai. Herein lies the difference that trust, and social capital make in the linefishery; where these are strong, bonding fishers together as well as creating bridges and links to other networks, collaboration and entrepreneurial growth become possible. In the absence of such strong, supportive networks built on a foundation of trust, and while fishers may assemble sufficient social capital around themselves to survive by joining alternative networks, the social capital required to thrive in the linefishery appears elusive (Ommer 2001; Foley et al. 2015).

When fishing conditions and policy were favourable for southern Cape linefishers in the late 1990s and early 2000s, some were able to accrue a considerable asset base, for example in Mosselbaai, which, combined with strong social capital and resulting collaboration, enabled those fishers to adapt in recent years by changing vessel type and thus target species.

However, without such periods of stability, opportunities for the accumulation of resources in support of adaptive capacity is limited. In this regard, it has been suggested that the ability and capacity to engage in adaptive or transformative behaviour are only built up periods of systemic stability (Béné et al. 2012). In Stilbaai, by comparison, the lifestyle focus of most linefishers, coupled with factors such as declining social capital between them and the concomitant move towards membership in alternative organisations and associations, has also resulted in a new state of relative stability outside of the fishery, but one which could be considered too resilient, particularly when compared with the more adaptive Mosselbaai fishers. In effect, this has rendered the Stilbaai fishers unable to transform their approach to fishing in response to the more dramatic changes facing their enterprise in recent years. However, a period of stability alone is not enough to create the prerequisite capacity to adapt or transform. It is the contention of this thesis that additional factors combine with periods of social-ecological stability and wellbeing to foster adaptive and transformative capacity. Trust and social capital are perhaps amongst the most important here; without the ability to work together and with others, when the time comes to respond to changes or shocks in the system, fishers' options are severely limited.

Building and increasing trust and social capital is not an easy process as demonstrated in the fieldwork. The findings of this research indicate that in the case of the southern Cape linefishery, it is not enough to follow established collaborative processes. With this said, factors were observed that contributed towards building trust and social capital. Where trust-building between the researcher and participants was concerned, for example, the successful components of the research indicate that ethnographic participant observation builds rapport and a foundation of trust with participants. Further to this, the participatory process as well as social learning exercises can serve to open conversations and build linkages between groups (McGregor 2014). In this regard, working with strong leaders also helps (Gutiérrez et al. 2011), however, as observed in the water temperature and integrated curriculum fieldwork, leaders can also serve to limit participation by acting as gatekeepers.

Systems thinking for the management of human activities in marine ecosystems inherently requires the integration of different positions and viewpoints. In a complex social-ecological system such as a fishery, where multiple competing interests are at stake, multiple perspectives and bodies of knowledge are required to assemble the pieces of the puzzle

(Ommer et al. 2007). However, unless there is sufficient trust both within and between groups, some sense of urgency of a problem to be solved, and sufficient social capital to 'oil' the communication and 'glue' participants together in collaborative processes (Scrivens and Smith 2013), old relationships of power and dominance will prevail, or participation will falter. Such a breakdown was observed, for example, in the stalled collaboration on temperature changes in the ocean habitat in which the linefishery operates and fisher Paul's unwillingness to invite a researcher onto his boat to test the water temperature measuring device. These conditions also led McGregor (2014) to recommend a focus on facilitation for social learning in the implementation of an EAF in the south African small pelagic fishery, for example, and McGregor et al. (2016) to emphasise the necessity of good knowledge and good processes, which are refined in the present work as being aware of different forms of trust and fostering social capital. In this sense then, trust and social capital are vital in a systems perspective for systems-based management in that they create the bonds, bridges and links enabling full participation of diverse stakeholders.

Theme two: Social and situated learning

Social learning has been shown to have a significant impact upon the adaptive capacity and resilience of social-ecological systems (Krasny et al. 2009; Tidball and Krasny 2011). Further, Armitage et al. (2017) propose that learning is a key condition for deliberate transformation in coastal communities. Following Lotz-Sisitka et al. (2015), where sustainability and learning research tend to focus on resilience- and adaptive capacity-building, in systems where resilience has become a maladaptive feature, transformative learning is necessary to initiate fundamental change.

In Vermaaklikheid School, the situated social learning approach resulted in a deliberate and fundamental change in the approach to teaching. Moreover, the work resulted in a transformative shift in the students' attitudes and behaviour as evidenced in the river clean-up exercise initiated by the students. This shift is important in the face of the infrastructure and resource scarcity facing the local context and considering students' embeddedness within a community characterised by reactivity (Gammage et al. 2017). The students' embeddedness served the additional function of enabling students to take the first steps in initiating conversations with community members around climate change and local social-

ecological challenges, with community members' positive feedback in turn suggesting the possibility for future learning exercises at the level of the community.

Where the bulk of literature on the subject describes work with adults, little research has been conducted amongst younger people (Krasny et al. 2009) in shaping the next generation of adult community members and leaders, a step which this work actively sought to take. By providing learners with critical thinking skills and encouraging the development of pro-environmental behaviour, the integrated teaching modules took steps towards initiating transformative social learning at the niche local level. It might be suggested that this work is thus limited in scope and scale, however, it is precisely from this level that social changes are catalysed which in turn can drive fundamental transformations in the broader system (Lotz-Sisitka et al. 2015). Encouraging people to not only to think *about*, but *for* their surroundings, situated social learning links human thought with sustainability actions which may have a positive impact on the social-ecological system. In this way, situated social learning can serve to foster cognitive and behavioural connections between social and ecological subsystems.

In their community research, the CUS team found that structural rigidities resulting from a lack of resources rendered many of the rural schools in which they worked unable to creatively adapt the curriculum to suite the local needs, constraining the education system in these coastal communities (Ommer et al. 2007). A similar lack of resources and creative adaptations were observed before the introduction of the integrated teaching modules. In line with the CURRA project's *Curriculum for Recovery*, however, focussing on local challenges and the surrounding environment in a situated approach, the successful results of the exercise in Vermaaklikheid School in augmenting the CAPS curriculum suggest here that a lack of resources need not act as a constraint in adapting a curriculum to suit the local context or needs of a community. Further to this, the opening of conversations within the broader Vermaaklikheid community resonates with Cundill et al.'s (2014) assertion that true social learning should contribute not only to the lives of immediate participants but expand into the broader local community. Cundill et al.'s (2014) research also found that community members were willing to engage in further learning once an introductory exercise had been conducted and the results of the current research also suggest that the process of opening conversations, initiated via the integrated teaching modules, served to

stimulate community members' willingness to engage further. The perceptible change in attitude and behaviour evidenced in the learner-initiated river clean-up also suggests the value of the modules in initiating a process of transformative, situated social learning in the school, and in turn the value of this process in a context of low adaptive capacity.

It was intended that the co-development and deployment process of the water temperature measuring device might serve to open a collaborative conversation between fishers and researchers. The forging of relationships 'linking' social capital in this way may serve to expose participants to new ways of thinking (Grafton 2005). In this way, by linking fishers to ongoing research into water temperatures in the Agulhas region, the exercise held the potential to initiate social learning amongst the participants. As such, it was envisaged that the process would result in the fishers developing new ways to collaborate with researchers (a process which has stalled countless times due to the aforementioned legacy of marginalisation and mistrust), but also in a broader understanding amongst the fishers of the influence of water temperature in the fishery. However, whilst Paul was initially keen to engage with researchers, the mistrust and unwillingness to fully engage in the participatory process to the end displayed by the fisher and his colleagues hindered the process of social learning here.

Theme three: Resilience and transformation

In the South African traditional inshore fisheries context, a series of intersecting governance (Hara and Raakjær 2009; Isaacs 2013b; Sowman et al. 2014), resource (Attwood et al. 2009; Gammage 2015), and policy challenges (Sowman 2006; Norton 2014; Sowman et al. 2014), have an impact on the resilience and vulnerability of linefishers. The resilience of a system is in flux and falls along a continuum, from absorptive capacity and persistence on the one end (Folke et al. 2010; Béné et al. 2012) to incremental change or adaptation (facilitated by adaptive capacity) (Béné et al. 2012) in the middle and finally full transformation into an altogether different state on the other end (Walker et al. 2004; Folke et al. 2010; Pelling and Manuel-Navarrete 2011). The vital step in engaging in applied research that complements the resilience of participants then, is to develop strategies which allow the three elements of resilience to flourish rather than focusing exclusively on one of the three (Béné et al. 2012). To this end, the participatory focus of the work sought to co-develop strategies which best fitted with the needs and context of the participants' lives.

Improvements in education and learning have been linked with improvements in resilience and adaptive capacity (Krasny et al. 2009; Cundill et al. 2014; Ban et al. 2015; Butler et al. 2015). Further, where deliberate transformations are desired, learning is necessary to equip participants with the knowledge and understanding to engage effectively in a purposeful manner (Lotz-Sisitka et al. 2015). In this regard, the present work looked at fundamental elements of the community, starting with Grade 7-9 high school learners as the foundation for new ways of thinking, questioning, and learning. The Vermaaklikheid community has been identified as vulnerable to social-ecological stressors, a situation compounded by its low education and income levels (Gammage 2015).

Absorptive and adaptive capacity were highlighted in the work on linefishers' organisations. Here, membership to the Mosselbaai organisation represented a means of consolidating the fishers' place in South Africa's fisheries and legacy in the region but also a means of adapting to a changing fishery by adopting new vessel types, target species, and fishing grounds. These findings resonate with Gammage et al.'s (2017) recent research in the region in which the authors identified the Mosselbaai linefishers as being relatively resilient, a trait accumulated through their business-focussed approach to fishing. In Stilbaai, by comparison, absorptive capacity was supported by the social capital garnered through membership of alternative voluntary organisations, however, the declining number of active fishers in the town over the duration of the fieldwork highlighted the lower resilience of these fishers in the face of declining social-ecological conditions.

Facing government marginalisation, resource competition, declining catches, shifting weather conditions, and changing consumer trends, the southern Cape linefishery will, of necessity need to improve its adaptive capacity and possibly its transformability, particularly where its continued dependence on the trawlers' middlemen is concerned. The case of the branding exercise evidenced an adaptive step in a situation where the impact of stressors could no longer be absorbed. With this said, whilst the Mosselbaai linefishers' adaptive capacity might be higher than that of their Stilbaai counterparts, the continued influence of the middlemen in the branding exercise demonstrated a limited ability to adapt or transform beyond established resilient strategies and structures.

In the recommendations of the CURRA project, entitle *Moving Forward*, it was suggested that emphasis be placed in the future on CSF-type models, public education around local

fish and fishing, and the branding of local fish (Neis et al. 2014). This support, it was argued, would serve to create employment and diversify local fisheries, with the authors recommending that support be given to public marketing of locally-sourced fish (Neis et al. 2014). The inability to fundamentally decrease reliance on the trawlers and middlemen observed in the current work, however, coupled with the ongoing marginalisation of the linefishery by government, suggests that such deliberate transformation is not possible under the current conditions of financial dominance imposed by the trawlers and middlemen.

This thesis has concerned itself with the smaller scales of the individual, group, and community. Given that this research is grounded in SES thinking, it is pertinent to consider how the niche examples of action research explored in the work speak to the broader system-wide challenges in the southern Cape. This question becomes all the more pertinent when one considers that the bulk of resilience literature considers transformations at the regional or global scales (Armitage et al. 2017), whilst the voice of the community is seldom heard (Ommer et al. 2007). Observing coastal communities is vital in understanding the impacts of social-ecological changes, given that they are often the worst and first affected by restructuring events (Ommer et al. 2007). Thus the focus on the small scale is by no means trivial, with transformation being both possible and necessary at smaller, 'niche' scales, e.g., as a foundation upon which to test and ultimately spread such changes to higher levels of scale (Lotz-Sisitka et al. 2015; Armitage et al. 2017). In other words, without bottom-up transformations at the small scale, "there can be no transformation at the global level" (Armitage et al. 2017: 8). In this regard, both the observations and exercises undertaken in this research highlight the challenges and opportunities for resilience-building across scales in the southern Cape.

With this said, however, it is also important to note that interventions in one setting are not necessarily applicable in another (Armitage et al. 2017). The successful implementation of the integrated teaching modules in Vermaaklikheid and their failed implementation in Melkhoutfontein is an example of this; despite similar circumstances of rural poverty, and with fewer resources at their disposal, the success in Vermaaklikheid did not readily translate to their neighbours.

Discussing the impacts of restructuring events on Canadian Newfoundland and Labrador coastal fishing communities, the CURRA project suggested that people's "…capacity to respond to these stresses without fundamentally changing their basic owner-operator, community-based structure and their regional and sectoral diversity is evidence of their resilience" (Neis et al. 2014: 6). This finding is significant in relation to the current work: despite the raft of challenges facing the southern Cape linefishery, participants continue to display resilience (particularly in the form of absorptive capacity with limited instances of adaptive capacity) with the same basic structures – such as owner-operators and middlemen - remaining firmly in place despite considerable and ongoing changes in the fishery throughout the fieldwork. Despite enabling their continued participation in the linefishery, however, this resilience displays maladaptive characteristics such as a reliance on middlemen for supply and distribution, and on inshore trawlers for access to resources and infrastructure. These features have become interwoven within fishers' strategies such that they limit their adaptive or transformative responses and thus the long-term adaptability or transformability of the fishery. In light of this, following the Coasts Under Stress project (Ommer et al. 2007: 442), future improvements in the resilience of the southern Cape linefishery will require "new ways to work out differences, share objectives, facilitate community learning and capacity building…".

Theme four: Participatory action research and co-development

Collaborative and participatory action approaches that incorporate local insights and knowledge into action responses have been shown to benefit resilience and result in the development of strategies suited to the specific challenges facing complex adaptive social-ecological systems (Brydon-Miller et al. 2003; Bradbury-Huang 2010). The participatory action approach to research thus represents a means by which people may be encouraged and empowered to actively engage with the social-ecological system rather than just thinking about it.

Despite its emphasis on collaboration, one of the ongoing challenges facing SES thinking, and one that underpins the thesis work, is the question of how to move from assessment and understanding to practical responses and strategies for managing and working with complex systems (Béné et al. 2011), effectively transmuting good theory into good practice with positive impacts in the system. Working with local people and perspectives

collaboratively and drawing from these insights to catalyse transformation lies at the heart of this research.

Greenwood et al. (1993) suggest that participatory action research operates along a continuum, with "expert research" tightly controlled by the researcher on one end, to full participatory action research on the other, in which collaboration between researcher(s) and participants is continual and immersive and focusses on understanding circumstances and the deployment of collaboratively co-created strategies designed to empower the group or organisation. The thesis fieldwork has sought, where possible, to operate at the collaborative, participatory end of the spectrum by involving participants early and deeply. Understanding the local context is key in such undertakings and allows for the development of action strategies that do not impose pre-formulated, 'top-down' structures on participants. Here ethnographic participant observation proved a vital research approach, serving to generate an understanding of context as well as building trust with participants. The persistent failure of fishers to supply data as part of the marine temperature monitoring exercise following the conclusion of the fieldwork suggests the importance of a continued research presence in driving certain collaborative ventures forward (Greenwood et al. 1993), particularly those in which participants do not necessarily see immediate benefits to their livelihood. In the case of the water temperature exercise, for example, Paul's adaptation of the device benefitted his fishing activities, but his colleagues, having switched to alternative fishing strategies over the course of the fieldwork, ultimately did not receive the same benefits from participation, highlighting the importance of a collaborative project appealing to all parties and remaining flexible and reflexive enough to incorporate such changes where possible. Similarly, in reference to reshaping education in an action-orientated, transformative way, Lotz-Sisitka (2015) suggests that the process requires the guidance of "interpretive actors". A tension has arisen here between the desire to conduct equitable co-production of knowledge and action strategies, and the need for interpretive actors to motivate and guide the process forwards.

Jacobsen et al. (2012) distinguish between utilitarian and radical action research, the former emphasising the participation of local people to more effectively meet a desired research goal and the latter looking to facilitate social transformation. Here the thesis settled on different points of the continuum at different stages of the research, drawn, for example, on

the one hand towards a utilitarian focus in the water temperature work, to a focus on social transformation via the integrated teaching modules.

In terms of conducting and assessing the value of action research, Bradbury-Huang (2010) suggests several terms which might be useful in an evaluation. The first are a pair; partnership and participation, representing the quality of relationships formed between researcher(s) and participants, and the extent to which the latter are involved as collaborators in the processes of designing and implementing products or processes (Bradbury-Huang 2010). Here the results of the fieldwork are mixed. On the one hand, the co-development of the water temperature measuring device, success of the teaching modules in Vermaaklikheid School, and continued open dialogue with the school and majority of fisher-participants following the conclusion of the fieldwork suggests that these partnerships and participation were positive and lasting.

However, the inability of Melkhoutfontein School to implement the integrated teaching modules and the failure of the fishers to supply water temperature data suggest here that participation and partnerships are not necessarily enough. Indeed, these results suggest that several other factors exert strong influence over the depth of participation and partnerships in the linefishery. The constraints of time and finances have been documented (Brown-Luthango 2013) as impacting upon people's willingness to participate. In the case of the water sampler this was expressed as a utilitarian interest in participating only insofar as it directly benefitted the fishers' livelihood and immediate future. Where Paul saw value in the device and was thus motivated to participate, for example, his colleagues' use of deckboats and targeting of different species resulted in their not seeing the value of the device to their immediate enterprise.

An additional complication in adopting an action research framework lies in risk taking (Simms 2013) with the prospect of high stakes testing, for example, posing a risk to participants. This failure, however, also surfaced important lessons around securing and maintaining teachers' interest, as well as the need to understand the limitations that the current national curriculum places on government-funded schools. The failed implementation of the teaching modules in Melkhoutfontein School also speaks to the role of school leaders in sustaining motivation but also as gatekeepers aiding or hindering the rollout of such programmes. Without their sustained buy-in, successful implementation is

limited. Indeed, leadership has been identified as a condition for transformation by Armitage et al. (2017) and the results of the fieldwork support this by highlighting the vital role played by leadership at various critical points in the research at times helping and hindering the process. On the one hand, leaders may compel their followers to remain motivated and invested in the process as occurred in Vermaaklikheid School, with the principal driving collaboration. In the case of the branding exercise, leadership was instrumental in securing the support amongst linefishers to supply the store, demonstrating entrepreneurial leadership characteristics (Purdue 2001).

The counterpoint to this is the potential for leaders to steer their followers away from collaboration as was evidenced in the case of the Mosselbaai leader's unwillingness to commit to the water temperature data collection. The chairman's insistence that such measurements were not directly valuable to the fishers and his concurrent refusal to take measurements using the water temperature sampler device saw the chairman acting as a gatekeeper, a finding which resonates with Isaacs and Mohamed's (2000) work on South African small-scale fisheries which found other organisation leaders acting as gatekeepers of knowledge.

Bradbury-Huang (2010) uses the term 'actionable' as the second criterion for evaluating participatory action research. The term describes how and how much the approach has resulted in changes in behaviour and attitudes that inform action future action responses (Bradbury-Huang 2010). This process is harder to assess, and readily influenced by changing circumstances and a range of drivers, however, the results of the integrated teaching modules and linefish rebranding exercises suggest that these components of the work were actionable to the extent that participants were able to change certain behaviours. However, with this said, the actionable nature of action research is highly variable as evidenced through the case of Melkhoutfontein School, stalling of the water temperature collection process, and continued influence of the middlemen in the linefishers' store.

The product co-development component of the work, premised on the notion that the direct, early, and continued involvement of lead user participants, played a strong role in rendering the exercises actionable. The incorporation of different knowledge perspectives has been noted by Armitage et al. (2017) as an integral condition for transformation in

coastal communities, and the lead user approach to co-development proved a useful tool in this regard.

Maintaining reflexivity and acknowledging one's influence in the process of participatory action research is the third of Bradbury-Huang's (2010) criteria of action research evaluation and is of critical importance given that the action-researcher acts as a catalyst and driver of change in the research setting. This thinking was particularly pertinent during the co-development phases of the research and highlighted the ability of the researcher to drive the research. Acknowledging the limits of both researchers' and participants' knowledge is a further key component of the reflexive process. At various points during the co-development of the water temperature measuring device and integrated teaching modules it was necessary to turn to outside experts when it was apparent that additional skills, knowledge, or expertise were necessary.

Bradbury-Huang (2010) suggests that the fourth and final characteristic of successful action research is that it should be significant and transformative, supporting the ability of participants to take action and enact strategies such that they, their communities and natural environment flourish. This is a challenging point to reconcile. On the one hand, the results of the integrated teaching modules in Vermaaklikheid including the unprompted plan by students to conduct a river clean-up speak to the modules having a relevance beyond the classroom in support of their social-ecological system. The integrated teaching modules utilised participatory action research and co-development as means of facilitating transformation by equipping the students and teachers with the knowledge and practical skills to think and act differently in their interactions with the surrounding environment, a finding which resonates with Armitage et al.'s (2017) suggestion that informed participatory processes foster conditions that contribute towards transformation. On the other hand, however, the continued influence of the middlemen and trawling companies in the branding exercise suggests that whilst the work resulted in participating fishers enacting a strategy to improve their position, deeply entrenched complicating factors including power, economic influence and monopolistic buying will need to be overcome in order for such strategies to become truly transformative.

One of the challenges of implementing the participatory action research paradigm is that it remains a relatively loose constellation of concepts, with limited guidelines, many of which

are shaped by the local context. This though, is also its strength, particularly when paired with the ethnographic participant observation approach to ground the action agenda in local understanding.

Recommendations and next steps

Each of the four central chapters of this thesis have detailed complex processes which were characterised by both successful and unsuccessful elements. An emergent body of literature has begun to highlight the value of failure as a tool to enhance future success, productivity, and learning (Scott and Vessey 2000; Van Der Helden et al. 2010; Kapur 2014). In the water temperature measuring project, the initial co-design phase of the research was tempered by the later unwillingness of fishers to continue the project. The integrated teaching modules work raised the challenge of high stakes testing. The work on fishers' organisations explored the foundations of success and failure in the social networks and bonds between people, and finally, the branding exercise was a mix of hurdles and achievements. Despite the perceived failures, important lessons can be learnt by analysing their underlying causes, leading Van Der Helden et al. (2010: 1596) to suggest that where instances of failure have occurred, learning from these events enables people to "select the actions that they know will have the greatest probability of success".

Considering the South African government's commitment to rolling out an EAF, and the concomitant lack of resources to oversee such a large-scale endeavour compounded by small-scale challenges, collaboration between researchers (both inter- and transdisciplinary) and natural resource users becomes ever more pressing. Future research will thus need to look towards collaboration that is beneficial to all involved not simply in financial terms but in improving knowledge, social learning, trust, social capital, and ultimately the capacity to adapt or transform sustainably in the face of change. In light of this, projects such as SCIFR represent an interdisciplinary approach grounded in SES thinking suited to such an agenda.

Regarding the water temperature measuring work, future research might explore fisher Robert's assertions regarding the accuracy of measuring the internal temperature of landed fish. Further to this, partnering with alternative networks identified in Chapter Four, such as the recreational fishers' association in Stilbaai, and active charter fishers in Mosselbaai and Stilbaai might serve to fill in the gaps whilst keeping costs to a minimum.

With the success of the integrated teaching modules in Vermaaklikheid, the opportunity exists for researchers and scientists to collaborate with the school to develop new modules, thereby addressing additional issues and answering other questions that so urgently need to be asked and answered. Further, the opportunity also now exists for other researchers to facilitate social learning and it is suggested that utilising the school itself, as a trusted space in the community, and again incorporating the students and teachers into the process might serve this purpose well. However, this step will still require the presence and participation of a trusted facilitator with contextual knowledge of the local situation in order to maintain relevance in the lessons and exercises. Further, the continued assistance of outside education experts will also be vital to ensure the quality of the teaching material provided.

Facing the imminent rollout of the SSFP, the ability of small-scale and traditional linefishers to add value to their products directly poses a significant opportunity. Future work in this field will need to explore means of overcoming the maladaptive economic and power structures that impaired the Mosselbaai linefishers' branding efforts as well as investigating means of adapting the retail store model developed by the Mosselbaai linefishers into a form which incorporates more sustainably caught species and addresses the high cost of initial investment.

A review of current literature on resilience, vulnerability, and adaptation, suggests that whilst much of it speaks to future planning, predictions, the development of methodology and approaches to support decision making, few studies have discussed the development of applied strategies in support of adaptation of transformation. Reality on the ground is often messy and local circumstances change in highly dynamic ways. Therefore, before implementing a strategy or policy in support of adaptation efforts, and before approaching people to converse about resilience, adaptation or transformation, it is necessary in each case to understand the local perspective and, importantly, look to ways of building local capacity to understand and deal with the impacts of changes in the system (Ommer et al. 2007; CURRA 2017a). The dynamics, unpredictability, and contextual nuances of social systems are such that additional, more fluid concepts are required to understand and explain complex interacting drivers such as leadership, trust, and learning in the South African linefishery.

Conclusions

Four central themes have emerged in this thesis, recurring at different points in the research and in different forms. These are: social capital and trust; social and situated learning; resilience and transformation; and participatory action research.

Resilience thinking provides a perspective through people might begin to consider the complex, interconnected and adaptive social-ecological systems in which they live. The participatory action and co-development processes utilised in the thesis fieldwork have underlined the ways in which participation at the niche local level may result in the generation of strategies that benefit local resilience, adaptive capacity, or transformations through an incorporation of local knowledge and contextual constraints.

Leadership has emerged in this thesis as a key factor in relation to all of the central themes. Recognising the role of leaders in shaping resilience responses to changing conditions is vital to future work. In addition to leadership, several intersecting factors shape the participatory and collaborative process including time and financial constraints, the high stakes testing that action approaches raise, and various lifestyle and economic foci that different people pursue. Further to this, several maladaptive features such as a reliance on middlemen have become intertwined within fishers' strategies. Unless these maladaptive features are diminished, they will continue to limit adaptive or transformative options in the linefishery.

It is the contention of this thesis that it is trust and social capital first, which inform participatory and collaborative success. Without sufficient trust it in the form of goodwill, competence, or political sentiment, participation and collaboration break down, as evidenced in the Stilbaai linefishers' organisation. Likewise, the various forms of social capital, including 'bonding', 'bridging' and 'linking' forms, significantly impact upon collaboration and participation. Simply offering people the opportunity to engage in one or the other is sufficient motivation to sustain participation or collaboration. Further, where relationships of trust are strained or break down, social capital is lost, hampering fishers' resilience to facing change. Where trust is stronger, people are able to form connections, linkages and networks to access further social capital, exposing themselves to opportunities which in turn build their resilience, as is evidenced in the Stilbaai fishers' use of civic organisations.

In order to establish these preconditions for resilience-building, deliberate transformations at the niche scale of the individual or group are often required which in turn serve to catalyse broader resilience-building in the system. However, deliberate transformations being their own pitfalls and dangers, necessitating a thorough understanding of why and how processes of trust and social learning do or do not work in the local context. To this end, the ethnographic approach fosters not only contextual understanding, but also builds the trust between researcher and participants necessary to engage in participatory action research towards building resilience. Continuous physical presence in the community in which the action research takes place is key to overcome obstacles.

Hand-in-hand with trust and social capital, learning, and in particular social and transformational learning, have imbued disadvantaged high school learners with the capacity to change their attitude and behaviour in the face of future change. Again, trust – and particularly the role of a community school as a trusted institution – has formed an important foundational component, influencing people's willingness to engage in social learning.

In the complex adaptive system of the southern Cape commercial linefishery, myriad intersecting factors threaten a fishery in need of strategies which will see it not absorbing the challenges, but actively adapting and/or transforming to meet them. This thesis has highlighted some of the predominant challenges as well as describing strategies derived using contemporary collaborative and participatory action approaches to address these from a local perspective. The work has emphasised the importance of four interconnected themes. Where social learning takes place, participants may become better informed and empowered to take decisions and actions which positively impact upon the social-ecological system in which they are embedded. Through trusting relationships, people accumulate the social capital necessary to bond, bridge, and link themselves with others in taking action. In so doing, these networks may develop the means to apply practical strategies in tackling pressing issues in the face of limited resources and marginalisation in mainstream fisheries management. Whilst some of the exercises as part of this thesis were more successful than others, the lessons learnt point to the possibilities for future collaboration, learning, and resilience in a fishery under change.

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Appendices

Appendix 1: Integrated teaching modules

)ate	Theme	Subject contents	Subject contents	Subject contents	Subject contents
5/03/2015	Data handling	**SCIENCE** Introduction to climate change and global warming	**MATHS** How and why mathematics in school is important after school		**HOMEWORK** Group poster on impacts of rising sea levels, temperature increase and ocean acidification to be presented to the clas
2/03/2015	Sea change	**ENGLISH** Interpreting information text on global sea temperature increase, its causes and effects. Each learner reads a paragraph and selects a question or point of interest to discuss individually	**SCIENCE** Sea temperatures and rising sea levels: overview, video, and Q&A	**MATHS** Data handling exercises – introduction to drawing temperature graphs	**Homework** Has the sea changed in my area? Working in groups of 3 or 4, speak to your family and community members about the importance of the se and fishing in their lives. How has fishing changed in the past 5 10 or 20 years? Take notes on what they say and prepare an informational poster on sea change in you area
3/03/2015	Sea change continued	**ENGLISH** Comprehension test on sea temperature	**SCIENCE** Presentation and Q&A on SCIFR marine water temperature project	**MATHS** Learners draw graphs of 2 months' worth of SCIFR water temperature data	**Homework** Group poster on sea change continued
3/03/2015	Ecosystems and Biodiversity	**ENGLISH** Recap of sea change and class presentations of posters; reading and comprehension lesson "What is biodiversity?"	**SCIENCE** Biodiversity lesson [Biodiversity for kids]; video: "what is biodiversity?"	**SCIENCE Practical** Outdoor Exercise: biodiversity connections [Biodiversity for kids]	**HOMEWORK** What is biodiversity? (questionnaire) [Biodiversity for kids; Exploring biodiversity

		[Biodiversity for kids; Exploring biodiversity]			
4/03/2015	Ecosystems and Biodiversity	**ENGLISH** Reading and comprehension test [Exploring biodiversity]	**SCIENCE double period** Short video: "Food chains, food webs, energy Pyramid in Ecosystems"; definitions and questions; Introduction to ecosystems	**ENGLISH** Reading exercise: Fishing down the food web	**Homework** Writing assignment - The importance of ecosystems: give a definition; explain why a healthy ecosystem is important; connections and how these affect other elements of the ecosystem
5/03/2015	Ecosystems and Biodiversity	**SCIENCE double period** Outdoor Exercise - ecosystem audit; class activity - forming an ecosystem and assessing impacts of change	**ART double period** Group exercise: create a biodiversity informational poster	**ENGLISH** Comprehension test [fishing down the food web]	**HOMEWORK** Using encyclopaedias National Geographic magazines and other source material, imagine you are a sea creature in an ecosystem. Detail the ecosystem you live in and the food web you form a part of. Imagine what would happen if one element of the food web and one of the ecosystem were removed. Presentation to class on 26/03
6/03/2015	Ecosystems and Biodiversity	**ENGLISH** Class oral presentation: my ecosystem and food web; Biodiversity song lyrics	**SCIENCE double period** Outdoor group exercise: "Bioblitz" ecosystem audit exercise near a local pond and stream [Bioblitz	**ART** Group exercise: Based on "bioblitz" findings, create a detailed biodiversity map, and explain why we can or cannot build a new	**HOMEWORK** In groups, create an A2 sized information poster and accompanying oral o biodiversity to be presented the next day

			survey in Biodiversity for kids]	classroom at the stream	
7/03/2015	Ecosystems and Biodiversity	**SCIENCE** Recap - video and discussion: food webs, biodiversity and ecosystems	**ENGLISH double period** Oral presentation of Biodiversity poster; Create a glossary of biodiversity and ecosystem terms		**HOMEWORK** practical exercise – build a marine food web

7/08/2015	Ocean acidification	**SCIENCE** Introduction to ocean acidification; video – A Sea Change	**ENGLISH** Class discussion and Questionnaire: A Sea Change	**SCIENCE** Introduction to pH	
8/08/2015	Ocean acidification	**ENGLISH** Reading and comprehension test: ocean acidification	**SCIENCE double period** pH and ocean acidification recap	**MATHS** Recap of graphs	**ART** Draw the pH scale an label it
9/08/2015	pH	**SCIENCE double period** Practical exercise – pH experiment using pH metre	**MATHS double period** Graphing pH readings		
0/08/2015	pH	**SCIENCE double period** Practical exercise – using litmus paper to assess pH			**HOMEWORK** Explain what pH is and discuss the exercises you have conducted in class to measure it.
1/08/2015	Student request sessions		**SCIENCE** Definitions: weather; climate; climate change		**HOMEWORK** Create a glossary of climate-related term

			etc.		
0/09/2015	Student request sessions	**VIDEO recap** Students requested short videos on a range of topics covered in the modules including ocean acidification, ecosystems, food webs, rising sea levels/global warming	**Student feedback session** Comments, questions and suggestions from the learners used to inform future development of the teaching modules		
0/01/2016	Revisions to teaching modules	Revisions included preparing teachers for handover – a transition from co-teaching (myself and the teacher) to the teacher alone taking the lesson			
8/01/2016	Sea change	**ENGLISH** Interpreting information text on global sea temperature increase, its causes and effects. Each learner reads a paragraph and selects a question or point of interest to discuss individually	**SCIENCE** Sea temperatures and rising sea levels: overview, video, and Q&A	**MATHS** Data handling exercises – introduction to drawing temperature graphs	**Homework** Has the sea changed in my area? Working in groups of 3 or 4, speak to your family and community members about the importance of the se and fishing in their lives. How has fishing changed in the past 5 10 or 20 years? Take notes on what they say and prepare an informational poster on sea change in you area
9/01/2016	Sea change continued	**ENGLISH** Comprehension test on sea temperature	**SCIENCE** Presentation and Q&A on SCIFR marine water temperature project	**MATHS** Learners draw graphs of 2 months' worth of SCIFR water temperature data	**Homework** Group poster on sea change continued

5/02/2016	Data handling	**SCIENCE** Introduction to climate change and global warming	**MATHS** How and why mathematics in school is important after school		
2/02/2016	Ecosystems and Biodiversity	**ENGLISH** Recap of sea change and class presentations of posters; reading and comprehension lesson "What is biodiversity?" [Biodiversity for kids; Exploring biodiversity]	**SCIENCE** Biodiversity lesson [Biodiversity for kids]; video: "what is biodiversity?"	**SCIENCE Practical** Outdoor Exercise: biodiversity connections [Biodiversity for kids]	**HOMEWORK** What is biodiversity? (questionnaire) [Biodiversity for kids; Exploring biodiversity
3/02/2016	Ecosystems and Biodiversity	**ENGLISH** Reading and comprehension test [Exploring biodiversity]	**SCIENCE double period** Short video: "Food chains, food webs, energy Pyramid in Ecosystems"; definitions and questions; Introduction to ecosystems	**ENGLISH** Comprehension test [fishing down the food web]	
3/03/2016	Ecosystems and Biodiversity	**SCIENCE double period** Outdoor Exercise - ecosystem audit; class activity - forming an ecosystem and assessing impacts of change	**ENGLISH** The importance of ecosystems: give a definition; explain why a healthy ecosystem is important; connections and how these affect other elements of the ecosystem	**ART double period** Imagine you are a sea creature in an ecosystem. Detail the ecosystem you live in and the food web you form a part of. Imagine what would happen if one element of the food web and one of the ecosystem were removed.	

4/03/2016	Ecosystems and Biodiversity	**ENGLISH** Class oral presentation: my ecosystem and food web	**SCIENCE double period** Outdoor group exercise: "Bioblitz" ecosystem audit exercise near a local pond and stream [Bioblitz survey in Biodiversity for kids]; create a detailed biodiversity map	**ART** In groups, create an A2 sized informational poster and accompanying oral on biodiversity to be presented the next day	**HOMEWORK** Complete your biodiversity poster and prepare your ora presentation
5/03/2016	Ecosystems and Biodiversity	**SCIENCE** Recap - video and discussion: food webs, biodiversity and ecosystems	**ENGLISH** Oral presentation of Biodiversity poster; create a glossary of biodiversity and ecosystem terms	**ART** Practical exercise – build a marine food web	**HOMEWORK** Practical exercise – build a marine food web

* Feedback from the learners and teachers after the first term suggested that the homework exercises were demanding of the learner's time and as such, both the lesson density and homework exercises were scaled back for the third term of 2015 and the first term of 2016 modules. Feedback at the end of the third term confirmed that the learners felt more able to enjoy the subject material without feeling pressured to spend their after-school time working.

Appendix 2: Supplementary teaching material

- Article: Office of Marine Sanctuaries, NOAA, Marine Osteoporosis – http://sanctuaries.noaa.gov/missions/2010aquarius/marineos.pdf
- Article: Photo in the News – Giant Squid Captured, Filmed for First Time http://news.nationalgeographic.com/news/2006/12/061222-giant-squid.html
- Article: Fishing Down the food web leaves fewer big fish, more small fish in past century: UBC research Media Release, University of British Columbia, (2011). Fishing Down the food web leaves fewer big fish, more small fish in past century http://news.ubc.ca/2011/02/18/fishing-down-the-food-web-leaves-fewer-big- fish-more-small-fish-in-past-century-ubc-research/
- Student activity: Science Learning – Build a marine food web http://sciencelearn.org.nz/Contexts/Life-in-the-Sea/Teaching-and-Learning-Approaches/Build-a-

marine-food-web

- Student activity: Shells and the impacts of Ocean Acidification
  http://www.cisanctuary.org/ocean-acidification/PDFs-WorkshopPage/Hands_on_activities/OA_Shells.pdf

- Lesson plan: The Ocean's Recipe for Success
  www.cisanctuary.org/ocean-acidification/PDFs-WorkshopPage/Hands_on_activities/Oceans_Recipe_for_Success_Lesson_Plan.pdf

- Teacher's Guide: Only One Ocean – Marine Science Activities for Grades 5-8.
  Halversen, C., Strang, C., and Hosoume, K. (2001). Only One Ocean – Marine Science Activities for Grades 5-8. Berkley: Lawrence Hall of Science, University of California

- Teacher's guide: Biodiversity for kids
  http://www.environment.nsw.gov.au/resources/education/BiodiversityTeachersGuide.pdf
  Papp, S., and Thompson, G. (2003). Biodiversity for Kids: Stage 2 Science – Teacher's Guide. New South Wales: NSW National Parks and Wildlife Service.

- Teacher's guide: Exploring biodiversity – a guide for educators around the world
  http://www.heritagecouncil.ie/fileadmin/user_upload/Publications/Education/exploring_biodiversity.pdf. Quesada, S., Lerda, D., Braus, J., England, J., Castro, H., Castro, F., Bishop, G., and Paratore, K. (1999). Conservation International and the World Wildlife Fund-US.

Appendix 3: Situated learning in action

Clockwise from top left: group presentation of community interviews; bio-blitz survey in school grounds; example of students' biodiversity poster; hands-on learning about pH