A review of environmental news reporting in South Africa: case studies on climate change and energy, fracking, and acid mine drainage.

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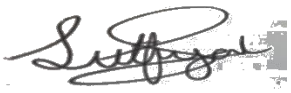
Declaration

I declare that this dissertation is my own, unaided work, unless otherwise noted within the text. It is being submitted for the Degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination in any other university.



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Abstract

Environmental communication in media has been studied largely in American and European contexts, since the 1990s. These studies have revealed the trends in reporting on the greatest environmental threats of our time, and the predominant framing of environmental risks, most notably those posed by climate change. Despite the crucial role that media plays in developing environmental narratives, few studies on environmental media reporting in developing nations, especially African nations, have been conducted. This research thus evaluates the media role in communicating environmental issues and environmental science in the South African media context. By conducting coverage and content analysis on three environmental issues at the core of the industrial development that underpins the South African economy: acid- mine drainage, fracking and climate change and energy, in five commercial newspapers, it is shown that South African media coverage of environmental issues is still limited by demographic factors which influence the news agenda of publications; that social framing of environmental news is important to environmental journalists and raising the environmental agenda in the newsroom; and government voices speak loudest on these important environmental issues.

Dedication

Through the years it has taken me to complete this dissertation, immeasurable thanks go to my mum, Maimuna Suliman, for her patience and love. To my sisters, Farhana and Ziya, for their undying belief in me and my capability. To my dad, and Karuna, for wise words. To my closest friends and especially Altamish, for always keeping me on my intellectual toes, for the debates and knowledge shares, but especially for the check- ups on progress, over years, even when I was unsure of when or how to continue. To those lab and department comrades with whom cups of tea and spoons of encouragement, perspective, and innovation were shared. May all of your inputs and positive influences be rewarded, Insha'Allah.

I am grateful for the nuanced environment that studentship allowed me- the challenges and opportunities, and the immeasurable intellectual growth that comes of being amongst enquiring minds. Finally, acknowledgements go to my supervisor, Dr Ute Schwaibold, for her encouragement and support in facilitating this interdisciplinary research in the Science Faculty.

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Layout of the dissertation

The dissertation starts with a theoretical framework and literature review which foregrounds the background research, research focus, aim, objectives and methodology. This is followed by three empirical research chapters, each of which responds to an objective of the research and each of which is structured as a stand- alone research paper; Chapter 2 examines the coverage and content of fracking, climate change and energy, and AMD issues in five South African newspapers. Chapter 3 reports on the perspectives of environmental journalists on environmental journalism. Chapter 4 highlights the findings on science and risk communication. Finally, there is a discussion chapter (Chapter 5) which speaks to all three research chapters; it is a synthesis of the findings of the research chapters, and responds directly to the aim of the research, examining the findings in light of their significance for environmental communication, and the relevance for environmental development in South Africa. A combined reference list is included at the end of the dissertation, followed by the appendices.

CHAPTER 1: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

In an industrialised and globalised world, the significance of an issue is often measured by the range and number of people who talk about it, and the 20th and 21st centuries saw many global leaders, scientists and citizens alike utilising and creating platforms to discuss the state of the environment. This is evidenced by the continued expansion of environmentalism: in the evolution of global environmental agencies and non-profits such as the International Union for the Conservation of Nature (IUCN, founded in 1948) and the World Wildlife Fund (WWF, founded in 1961), the creation of international, government-affiliated environmental networks such as the United Nations Environment Programme (UNEP) in 1972 and the International Panel on Climate Change (IPCC) in 1988, and the emergence of grass roots environmental organisations in both developed and developing nations. What is commonly recognised by these varied groups, is that the biggest threats to the environment continue to be linked to unsustainable industrial and urban activity (UNEP, 2016). Despite the increasing recognition of environmental threats at multiple levels of society, the state of the environment worsens both globally and locally (Department of Environmental Affairs, 2012; UNEP, 2016b) and the role of environmental values and ethics in fostering healthy environmental behaviours and practices is questioned. The biggest threats to the environment include climate change, biodiversity loss (Alkemade *et al*., 2009) and worsening ocean health (Halpern *et al*., 2016), and the discourse around these issues is wide-reaching, linking to issues such as economic inequality, human settlement patterns and indigenous knowledge (UNEP 2012). The monitoring and resolution of environmental problems is meanwhile sought through science, information, technology and data (UNEP, 2016). With global, national and local environmental discourse being embedded in communication, collaboration and science, mass media plays a central role in the development of environmental behaviours and governance (Hansen, 2011; Boykoff and Yulsman, 2013).

1.1 Environmental discourse in South Africa

The legacy of apartheid has shaped South Africa's economic and geographical landscape, and subsequently our impact on the environment. The development trajectory that South Africa followed under colonialism, much like in the rest of Africa, placed power in the hands of a privileged, white elite; it disenfranchised the black majority and built a socio-economic system that was geared towards extractive industry and export (Maylam, 2017). Prior to 1994, the Group Areas Act and geospatial policy resulted in South Africa's majority black, rural population, living on and off a small portion of the land (Meadows and Hoffman, 2002). Meadows and Hoffmann (2002, p429) note this 'differential access' to land as a factor that has influenced land degradation. In urban areas, segregation policies and geospatial planning resulted in the majority of the urban, black population living in underserviced townships on the periphery of the cities (for example, Alexandra township in Gauteng) or in townships that were situated many kilometres away from commercial areas (Kloppers and Pienaar,2014), for example, Soweto.

Redressing the steep inequality of livelihood, lifestyle, opportunity and service delivery was the task of the South African government post-1994, and this was ostensibly sought through rapid industrial development in the mining, energy and agricultural sectors. The introduction of Industrial Development Zones (IDZs) is one example of this post-apartheid development policy (Kalumba *et al*., 2017). The legacy of land distribution and tenure policies, industrial development and urbanisation in South Africa has fomented many of the pressing environmental challenges that we face (Hallowes, 2011). Before and even after apartheid, mining of coal, gold, platinum and other valuable minerals was a major contributor to South Africa's economy (Fine and Rustomjee, 1996), and even though it is presently only the 6th largest contributor to GDP in South Africa (DEA, 2012), its legacy continues to impact on the environment. Irresponsible mining practices have led to water, land and air pollution while rapid urbanisation has placed stress on urban ecosystems, agricultural systems and energy demands (DEA, 2012).

Two decades into democracy, South Africa still relies heavily on industry to provide for our energy needs, with 77% of primary energy derived from coal (Eskom, 2016), and with the

reliance on mining and minerals to supply our energy and economic needs resulting in the minerals-energy complex (MEC) (Mondi and Bardien, 2013; Swilling, Musango and Wakeford, 2015). Other key mining impacts highlighted as major environmental challenges focus heavily on water resources and include changes in the water table, eutrophication and accumulation of heavy metals in water resources and wetland degradation. With water scarcity being a major concern in southern Africa, acid mine drainage is cited as potentially being the most costly cause of water contamination (DEA, 2012). The impact of mining and its status in the South African economy highlights the underlying drivers of environmental change in South Africa, and the impact of our patterns of energy production and consumption.

Climate change and sustainability in South Africa are closely linked with the impacts of mining and development on South Africa's environmental health, and climate change is expected to have far-reaching effects in South Africa. Increased carbon dioxide levels and changing weather patterns are expected to impact on biomes. Bush encroachment, the spread of invasive species and changes in vegetation composition and structure, will impact on ecosystem services (Midgley and Thuiller, 2010). In the oceans, disruptions to important chemical processes, increased sea temperatures and shifting of ranges for some marine species are predicted. This impacts negatively on marine biodiversity and fish stocks, and is thus also a concern to food security (SANBI, 2012). Media has played a role in bringing these and other environmental challenges to light, with a notable example of rhino poaching in southern Africa (Gandiwa *et al*., 2014).

1.2 Environmental news and the media industry

Globally, media attention to environmental issues has increased over the past few decades. Research has questioned how the public view the environment, and how various media - from the news media reporting on environmental disasters, to the entertainment and film industry - shape public perceptions on environmental issues, through their portrayal of the environment and its relative importance within stories (Boykoff, 2009). The rise of the environment as a coherent category on the global news agenda is attributed to events of the 1970s, when debates around industrial pollution and toxic agri-chemicals in food systems in

the United States started to receive notable media attention (Mazur and Lee, 1993; Hansen, 2011). Since then, the controversies and complexities that reporting on environmental news has presented, have opened the door for research into the nature of environmental journalism, its role in communication and the impact it has on environmental values and behaviours (Lewis, 2000; Fung *et al*., 2011). Research has been carried out largely in North American and European contexts, though it is agreed that media has both been shaped by environmental science, and has helped shape the way the public view environmental science around the world (Boykoff, 2009). Furthermore, these values and cultural systems that are influenced by media are recognised as drivers of environmental change (UNEP, 2012).

In addition, there is a strong relationship between environmental communication and science communication. This is highlighted over the last decade by the climate change debate, in which the scientific validity of the geophysical evidence for global warming was questioned (Hobson and Niemeyer, 2013; Anderegg and Goldsmith, 2014). The solutions to environmental problems are frequently to be found through scientific inquiry, and science is often viewed as the ultimate authority on solving environmental challenges (Scott and Barnett, 2009; Anderson *et al*., 2012). It also follows that the communication of ecological concepts, which are generated largely by the scientific community, is not easy and bridging the gap of environmental knowledge between academics and the public, business and government, is a challenge to journalists who themselves are often unfamiliar with many scientific concepts (Besley and Nisbett, 2011; Brossard and Scheufele, 2013). Another issue to consider is that, despite the enduring importance of indigenous knowledge, there is a narrative binary that separates and excludes indigenous knowledge systems (IKS) from mainstream science (du Plessis, 2017). The predominant media narrative of environmental risk and environmental problem-solving is one that places western, academic science at the forefront (du Plessis, 2017). Furthermore, journalistic and scientific disciplines have differing urgencies when writing about science; while scientists' first priority may be to apply caution and draw only accurate and conservative conclusions from their data and research, journalists often prioritise using data to find an 'interesting' or novel story angle, and this has been particularly true for the issue of climate change (Anderson *et al*., 2012). The

relationship between environmental science, media and the public is thus complex, requiring consideration of all these factors.

The global news media industry has adapted and evolved over many years. Whilst an exhaustive review of these changes is outside the scope of this research, there are several aspects of the current news media industry including ownership (concentration), control and distribution that play a role in the way that journalism is produced (McNair, 2006). The most notable development of the last twenty years is the use of the internet and the movement of news to the digital space (Boykoff and Yulsman, 2013); old media (print, television, radio) now compete with the new media (online) for customers and revenue, and multimedia approach to news reporting is becoming more popular. It is suggested that the global recession of 2008 has also played a role in downsizing newsrooms in some instances (Boykoff and Yulsman, 2013). In the United States, newspapers have adapted to the challenges that the rise of digital media has posed by introducing online newspapers, websites and blogs; 'paywalls' (where consumers are required to sign up and pay a fee to view content) have been introduced to recover revenue but despite this, the revenue made from digital advertising is not on par with what was previously made through print (PEJ, 2013). Another adaptation noted by Boykoff and Yulsman (2013) is the increase in non-profit and independent journalism such as iNews and Grist. These news outlets often focus specifically on environmental issues and produce in-depth, investigative journalism.

1.3 The South African media environment

The widespread availability of media resources suggests that media plays a growing and central role in South African society. Broadcast media in South Africa is regulated by the Independent Communications Authority of South Africa (ICASA), while print media is self-regulated through independent organisations such as the Press Council of South Africa, which work to resolve issues between the public and newspapers or magazines over editorial content. The Media Development and Diversity Agency (MDDA) describes South Africa as having a dynamic and varied media industry with more than 30 million people having access to some type of media. In 2009 their research found that radio was the medium with the greatest reach (94.1 % of the adult population had access by 2009), closely

followed by television (83.4 % of the adult population), while it was reported that print media garnered 48% of the total audience as readership (MDDA, 2009). Since then the task of quantifying media penetration appears to have fallen largely to private companies, with OMD (Omnicom Media Group South Africa) reporting in 2016 that 92.3% of the South Africans over the age of 15 have access to radio and TV, and 45.9 % have access to newspapers. With regards to the digital space, in recent years the high cost of data has been highlighted as a major hurdle to the expansion of digital consumerism in South Africa, with many arguing further that this 'digital exclusion' also limits the developmental capacity of individuals (De Lanerolle, 2016; Martin *et al*., 2016).

While radio and television media are becoming more popular choices for media consumers in South Africa, print media is in decline. The Audit Bureau of Circulation (ABC, 2010) reported decreasing sales for many daily newspapers across provinces between 2009 and 2010, with *The Star, Pretoria News, Cape Argus* and *Cape Times* falling approximately 20%, The Daily News falling 10% and The Mercury sales dropping by 5%. The reasons suggested by editors and journalists for the fall of print media include the failure of the journalism business model, where news agencies rely on advertising revenue for income. They also cite the rise of new (online and interactive) media and the impact of social media on traditional news delivery structures (C. Russel, editor of the *Saturday Star*- pers. comm.) as threats to the print industry. Despite the challenges facing print news and the increasing popularity of digital news, digital news is often supported directly by print news outlets (for example the *Mail and Guardian, City Press, IOL* and *Business Day* websites), and it is a reliable form of media for media content analysis.

1.4 Science, worldviews and framing

The different forms of news media - print, television, radio and digital - all have the ability to influence society through framing and their impact on worldviews. A worldview is the way in which an individual or group perceives the world. It encompasses their notions of reality, objects and people, the relationships between them, and ways of understanding which experiences are good and which are bad. Worldviews are formed and reinforced through an individual's experiences and will inform and direct an individual's decisions and priorities;

they assist individuals to regulate, assess, perceive or interpret information (Kantor and Lehr, 1975.) The 'ecological worldview', first assessed by Dunlap *et al.* (2000) who defined it as an individual's ecological considerations, is also shaped by news media. Together with their economic means, it is this set of environmental beliefs and attitudes that ultimately determines a consumer's choices and trade-offs, which may have positive or negative impacts on the environment. Media can therefore play a role in influencing consumers' environmental worldviews and thus their environmental impact, through their messaging and framing of environmental news (Koltko-Rivera, 2004; Milstein, 2009; Fung *et al*., 2011). Recent studies continue to confirm the role of media in informing and educating citizens about the environment, and fostering environmental citizenship (Takahashi *et al*., 2017).

The manner in which news is put forward - the style, tone, content and coverage - all contribute to the way in which news is framed. Fung *et al*. (2011: 557) define framing as "the process by which news accounts influence individuals' information processing and social judgements". Media framing therefore is the mechanism through which media influences worldviews and subsequently decision-making and behaviour. Media framing can interact with an individual's ecological worldviews to strengthen their belief in and support for certain environmental policies, if the media framing and policy pertaining to an issue are formed from the same worldview as that which is held by the media consumer (Fung *et al.*, 2011). Media is important for framing worldviews and attitudes of the public and decision-makers, especially on contentious issues such as climate change or fracking, and some suggest that worldviews are being intentionally polarised through media framing to create incompatibility and discourage dialogue (Fung *et al.*, 2011; Painter and Ashe, 2012). It is suggested by Painter and Ashe (2012) that the framing of 'climate scepticism' in some countries, most notably the United States, has created the impression that the professional opinion is divided. This then has an impact on public endorsement of policies which favour sustainable practices. It is therefore important for scientists and government, when suggesting plans and measures which mitigate negative impacts on the environment, to understand that worldviews, value systems and individual knowledge or values may influence public choices and thus the efficiency of the measures taken to remediate problems (Poortinga *et al.*, 2004).

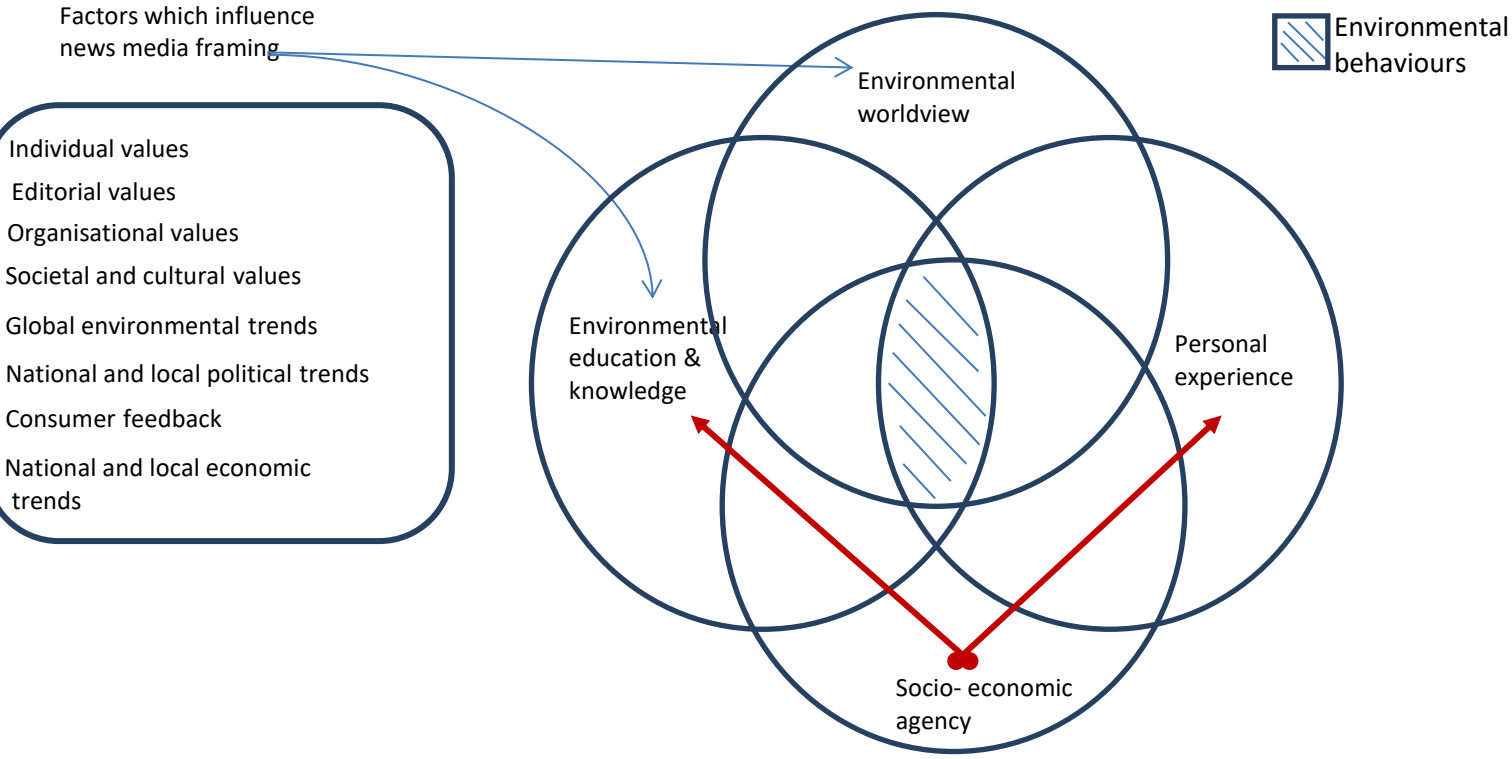

Figure 1.1. What influences environmental behaviour? Concept map indicating the factors which influence environmental behaviour and interaction of media framing with environmental behaviour formation. The influence of socio- economic agency in environmental decision making is shown by the red arrows (sources: Kantor and Lehr(1975), Boykoff)2009), Dunlap *et al*.,(2000); Koltko- Rivera (2004); Milstein (2009); Fung *et al*., (2011), Poortinga *et al*.(2004); Anderson *et al*. (2012); Freund (2001) and du Plessis (2017) Anand and Sen (2000))

The impacts of the digital revolution and the challenges that exist in the media industry to create sustainable revenue models have not been limited to the United States and Europe. However, studies on environmental and science journalism conducted in developing nations suggest that it is a growing rather than shrinking field. Boykoff and Yulsman (2013) cite the formation of the World Federation of Science Journalists (WSFJ) in 2002, and the approximately 600 science journalists working in Africa and Arab countries as of 2009, as proof of this. The print media industry of India is one of the largest in the world, and continues to grow; Mittal (2012) describes at least three of the most prominent English-language newspapers in India as having dedicated climate change sections. Linnarz and Glaeser (2012), in a comprehensive review of

environmental journalism in the Asia-Pacific region, suggest that, for many newsrooms in these countries, the factors which hinder greater environmental coverage and quality reporting are more closely linked to politics, education and perceptions of newsworthiness.

The trends in studies carried out on media and science communication in the developing world tend to focus not only on coverage, but the local context surrounding framing, messaging and social advocacy (see Boateng and Akusoa, 1993; Gandiwa *et al*., 2014; Batta *et al*., 2015). Research in the developing world appears to comprise largely of isolated studies aimed at answering localised questions. It is thus challenging to draw parallels in methodology and research questions, and identify similar findings. However, the recent global focus on climate change since the late 1990s and early 2000s provides one example of a platform for comparison. The tendency of media to be events- or catastrophe- driven (Anderson 1997; Lawhon, 2004; Boykoff and Roberts, 2007) means that a majority of the studies on environmental media and journalism focus on analysing the coverage, framing and scepticism around climate change issues, whilst fewer media studies focusing on other environmental challenges have been carried out. This focus around major events or disasters has been demonstrated in several studies in contexts outside of Europe and the United States. Lawhon (2004) comprehensively summarises the findings of studies on African environmental journalism from the early 1990s to early 2000s; earlier research suggested that environmental news is events-driven -a study by Nyirenda (1993) in Zambia assessed two national papers and concluded that news covered more disaster than non-disaster events, while Boateng and Akosua (1993) carried out research in Ghanaian press and found that, as well as news being events-driven, news media can play a role in education and public opinion. According to Boateng and Akosua's (1993) study, most environmentalists were obtaining their information from sources other than mass media, while in Barimah's 2015 study, which assessed knowledge of climate change amongst society (including farmers, civil servants and students) in Ghana, respondents identified mass media as their primary source of information on the issue.

Research on environmental issues in the media has also investigated the pitfalls of the media industry and the challenges that journalists face when reporting on environmental issues. The general problems cited in developing nations include a lack of training, unsupportive editors and

limited access to information, interviewees and funding (Shanahan, 2009; Boykoff and Roberts, 2007). These challenges, while exacerbated by the lower levels of development, media infrastructure and funding, are not unique to the developing world.

Closely tied with the concept of media production and agency is press freedom. The degree of freedom of expression within the media industry varies greatly from country to country. Challenges to environmental press freedom include the barring of journalists from fora, meetings and events, hurdles to accessing information including environmental reports and environmental data, and the arrest and physical and legal harassment of journalists covering environmental issues and protests (RSF, 2015). Of further concern globally is the killing of environmental activists. A report compiled by Global Witness in 2014 cites activist killings as a major threat to environmental preservation and justice, having found that at least 908 citizens were killed while protecting rights to their land and environment between 2002 and 2013, with 147 deaths recorded in 2012. Those killed included, amongst others, journalists. Reporters Without Borders (RSF) stated in their 2015 report 'Hostile Climate for Environmental Journalists', that at least 10 environmental reporters were killed between 2010 and 2015.

1.5 Environmental framing; political ecology, environmental justice and the economy

The interconnectedness of environmental issues carries into environmental journalism (Boykoff and Boykoff, 2007) and the themes and trends in analysis of environmental journalism have included aspects of political ecology, environmental justice and sustainable development (Cock, 2006). Political ecology is concerned with understanding the role of power relations in the management of the environment and resources, and analyses impacts as influenced by factors such as race, gender and class (Lawhon, 2011). The end of apartheid stimulated development in the way in which 'the environment' was conceptualised, broadening the concept of ecology to "include the living and working space of black South Africans" (McDonald, 2004). Environmental justice has arguably articulated the common goal for many environmental NGOs, many of which have been key role-players in bringing polluters to task and dealing with issues of water and air pollution, food security and renewable energy. Since the end of apartheid, the environmental discourse has moved towards being more strongly people-oriented, with a focus on the relationships between pollution, poverty and political and economic exclusion (Barnett and

Svendson, 2002). The value of social movement activists as sources for environmental journalists has reportedly been enhanced due to this shift in focus (Barnett and Svendson, 2002). However, little is known about how these developments in the environmental sphere have been reflected in news media. Media has played a role in bringing these and other environmental challenges to light, with a notable example of rhino poaching in southern Africa (Gandiwa *et al*., 2014).

Environmental ideology in South Africa is varied and at times disparate, lacking a single unifying discourse (Cock, 2004). This is argued to be due largely to the diversity of socio- economic contexts which exist in South Africa (Cock, 2004). South African society is defined by its socio-economic inequality, with a wealthy minority, a growing middle class, and a majority living within the shadow of poverty. Environmental narratives are often analysed as being either concerned with 'green' issues- referring to issues of conservation of species and habitat destruction (such as the current rhino poaching issue in South Africa)-or with 'brown' issues, which refer to environmental issues which have human impacts (such as pollution, access to water and energy) and are often associated with social justice movements (Shanahan, 1997; Cock, 2004; Scott and Barnett, 2008). The green issues are associated with mainstream, middle class environmental movements, while brown issues are associated with grassroots, lower- working class environmental movements (Jones, 2012). This said, environmental movements in post- apartheid South Africa are still evolving; this broad categorisation can be effective but the interconnected roles of both social and conservation NGOs, business and government, make for a dynamic environmental discourse.

The relative dynamism of the ideology is also apparent in the media discourse and narrative. A study by Lawhon (2004) asserted that 'green' themes still dominated the environmental discourse in the Kwazulu Natal (KZN) daily paper, the Natal Witness*,* with green themes found in 48% of the stories in the study, while brown themes were found in 17% of the stories. According to Barnett and Svendson (2002), another KZN newspaper, The Mercury, widely publicised the issue of air pollution in South Durban, successfully articulating a 'brown issue' in what was considered a mainstream, middle class publication. Previous analysis showed that perspectives on the role of media are diverse, however the dominant rhetoric concludes that the role of media cannot be unlinked from the context of South Africa's past and socio- political issues

(Steenveld, 2004) and should aim to facilitate democratic change (Shepperson and Tomaselli 2002; Wasserman 2006). The juxtaposition of social or brown themes versus ecological or green themes within environmental journalism has been investigated internationally. In a comparison of Indian and UK media, Chapman (1997) described a value split where western news values (such as impartiality) are contrasted by social advocacy journalism. Chapman's (2007) research describes people in India as having greater awareness of 'brown' (socio- environmental) issues than green (conservation) issues, whilst individuals in the UK were more aware of green issues, but that this awareness did not translate to action unless the impacts were local. To this end, political ecology thus provides a useful and comparative framework for situating the findings of the analysis.

Within political ecology exists the concept of environmental justice, where it is defined as being the basis of an environmental movement and paradigm. It advocates for environmental protection and conservation in which the rights of society and communities are integral and central, specifically politically and economically marginalised communities which are often the most highly impacted by environmental problems (Taylor, 2000; Cock, 2006; Schlosberg, 2013; Martinez- Alier, Tempe, del Bene *et al*., 2016). Cock (2006) argued that environmental justice is an important and growing frame in the South African environmentalist movement, and can be seen as the response to the mainstream conservation- centric narrative of the past. It is considered a grassroots- driven, bottom- up and mobilising force within the scope of South African environmentalism. The environmental justice movement has been a successful force in confronting environmental pollution, not only in South Africa (for example the SDCEA challenging industrial pollution and inequality), but around the world (Scott and Barnett, 2008; Martinez-Alier, Tempe, del Bene *et al*., 2016). South African environmental justice NGOs (such as CER, EJNF, Groundwork) thus also aim to utilise legislation to combat environmental crime and protect communities from pollution. Environmental legislation as laid out by Section 24 of the South African constitution and NEMA are both underpinned by the rights of society to a healthy environment and promote environmental management which serves society in an equitable and sustainable manner (Section 24a,b., 1996; NEMA, Act 107 of 1998). Environmental justice is increasingly relevant to South Africa's framing of the environment, as the mainstream, middle-class, predominantly white environmental rhetoric arguably excludes the black majority from engaging in the environmental conversation (discussed in- depth by Freund, 2001). While there is

no unified and identifiable single voice for environmental justice movements in South Africa or globally (Cock, 2006; Schlosberg, 2013) one of the key tenants common to this frame and its criticisms of mainstream environmentalism is that environmentalism needs to be inclusive of the poor and marginalised if it is to be effective and impactful (Martinez- Alier, 2002; Cock, 2006; Schlosberg, 2013).

As well as being embedded in power and politics, environmental issues related to industrial development and energy are linked intrinsically to the economic development of South Africa, and thus sustainable development and the green economy. The substantive principles of the National Framework for Sustainable Development (2008) call for the efficient and sustainable use of natural resources and state that resources which are necessary for long- term survival should not be destroyed for short term gain. Climate change is also highlighted in the NFSD as a major global trend to be considered, as well as the rising cost of commodities and natural resource use. These framework principles relate sustainable resource use, the capacity of the public to participate in an informed way and climate change to sustainability policy. Objectives of the green economy at a macro and micro level are linked to both urban and rural sustainability, for example water and waste management, green infrastructure, renewable energy use, land management and organic agriculture. Water and energy are key components of the green economy (Gulati, 2015).

1.6 Key environmental impacts

Although the environmental beat is still largely regarded as a niche or elite interest in the South African media (Mare, 2011; Jones, 2012), with priority given to political news, it is characterised, like any other section of the news, by several 'hot topics', buzz-words and controversial issues which appear to take precedence within the environmental news agenda. With this focus in mind, I also considered the following criteria when selecting the case studies: i) that the issue should have significant impacts on environmental and human health in South Africa; ii) the issue should be covered sufficiently in the news to contribute to a data set; iii) the issue should be of current, ongoing concern to environmental and human health; and finally iv) the issue should be of high concern to industrial and economic development.

To fulfil these criteria, Fracking, Acid Mine Drainage (AMD) and Climate Change and Energy were chosen as the key environmental issues for this study. These topics all feature prominently in the South African media discourse, bear significant economic and industrial importance and have existing or potential impacts on environmental health.

Fracking: The use of hydraulic fracturing (commonly referred to as 'fracking') to extract shale gas in the Karoo region of South Africa has been a highly controversial issue in the South African media. The fracking process involves drilling two or more kilometres into the shale rock beneath the earth's surface, injecting a high- pressure mix of water, sand and chemicals into the rock and pumping the gas or oil that is forced out of small fissures in the rock into the water stream to the surface, where it is collected and refined for commercial sale. The shale gas fields proposed for fracking are located in the southern area of the Great Karoo, in the Western Province of South Africa. It is a semi-arid region, receiving on average >200mm rainfall per year. The methane gas reserves are estimated to be the fifth largest in the world (Jackson *et al.*, 2012). Livelihoods in the Karoo depend on sheep farming and to some extent ecotourism from game farming. Farmers rely heavily on groundwater sources to meet their water requirements (Beaufort West Municipality, 2014) and fracking could have negative effects on water security (van Tonder *et al*., 2012). Fracking has been used in many countries including China and the Netherlands, used in several states in the United States, and in the United Kingdom where it was unbanned in 2012 (Fig, 2011). However, due to its potentially harmful effects on the environment, it has been banned in France and some states in the United States, while countries such as Germany have declared a moratorium on fracking until the long term risks are fully understood and accounted for (Fig, 2011). The South African moratorium that had been placed on fracking in July 2011 was lifted in September 2012, allowing companies such as Shell and Falcon to continue scoping operations for proposed fracking (Fig, 2011). As of 2017, no decisions had been formally taken by government on the exploration rights applications (Scholes and Schreiner, 2017), and the Strategic Environmental Assessment for Shale Gas Development report of October 2016 states that limited water resources place a great constraint on the viability of fracking in South Africa.

Fracking is not only an environmental issue, but also a socio-economic and subsequently political issue (Fig, 2011, van Tonder *et al*., 2013). Fracking is seen as a low-emission alternative to South

Africa's coal- reliant energy industry (South African Department of Energy, 2013). In 2011, the National Planning Commission (NPC) stated that shale gas would play a role in the county's future energy mix (NPC, 2011). While the economic viability of fracking has yet to be established, it is reported that the reserves, estimated at 450 trillion cubic feet, could contribute significantly to energy demands, and thus economic growth and job creation (Jackson and Twine, 2012). Government is seen as being optimistic about fracking in the Karoo largely due to these potential economic benefits and a possible reduction in coal- reliance to meet South Africa's energy needs (Vermeulen, 2012). In a South African context, the environmental risks posed by fracking include groundwater contamination, the release of large amounts of greenhouse gases and possible earth tremors. The large quantities of water it requires are considered a great drawback in a water scarce South Africa (Vermeulen, 2012), where water resource development should ideally occur within the frameworks of equity, efficiency and sustainability (Beekman, 2003:1).

Climate Change: Climate change is caused by increases in greenhouse gases (GHGs), such as CO2, in the earth's atmosphere. These GHGs absorb infrared radiation that is usually reflected from the surface of the earth. As the amount of radiation trapped in the atmosphere increases, Earth's temperature rises, which impacts on global weather patterns. The global effects of climate change include altered weather and rainfall patterns and increased average global temperatures. For South Africa, climate change is expected to contribute to increased occurrence of extreme weather events (such as higher average temperatures, floods and intense and longer droughts) and an overall drying trend resulting in decreased water availability (Putt del Pino and Bhatia, 2002; The Government of South Africa *National Climate Change Response Paper*, 2011). The consequences for South African weather patterns and ecosystems are expected to impact on virtually every aspect of both urban and rural livelihoods; human health, agriculture, mining and electricity generating sectors will be negatively affected, while mass extinctions of animal and plant species will reduce biodiversity and impact on the ecosystem services that are vital to communities (DEA, 2016).

The poor are expected to suffer the greatest consequences brought about by climate change (Phalatse and Mbara, 2009; The Government of South Africa, *National Climate Change Response White Paper*, 2011). In light of the challenges posed by climate change, South Africa has accepted the conclusions of the IPCC, and is signatory to the Kyoto Protocol, the UNFCCC and Paris

Agreement (SA-INDC, 2015); regulatory frameworks and policies designed to mitigate and adapt to climate change. Commitments laid out in the National Climate Change Response White Paper (2011) include the development and implementation of training, education and public awareness programmes on climate change and its effects, and a commitment to advocate for scientific skills, access to information and public participation in addressing climate change. Section 11.2 further states that understanding the concept of climate change and the options for mitigation and adaptation is fundamental to development pathways and societal wellbeing. This demonstrates the importance of a well- informed public to tackling climate change. However, climate change is often a poorly understood concept and explanations of the processes and impacts necessitate an understanding of the underlying scientific principles. Additionally, unlike fracking and acid mine drainage, the tangible effects of climate change on the environment and communities may be difficult to identify and quantify, with scientific projections expecting the most drastic temperature increases of 3- 4 ° C to occur between 2050 and 2100 (IPCC, 2014). This dynamic therefore represents a challenge to journalists in terms of the typical cyclical and incidence- based reporting tendencies (a dynamic described in detail by Lawhon, 2004), and also brings into question the representation of risk and what qualifies as an 'extreme weather event'. There has also been a slow but evident change in the climate change rhetoric as global media attention is moving away from debating whether climate change is real and has anthropogenic causes, and towards looking at adaptation and mitigation measures (Lawhon, 2004; Anderson, 2007).

Acid mine drainage: The issue of acid mine drainage (AMD) in South Africa has existed for many decades and is part of the country's mining legacy (McCarthy, 2011). AMD occurs when iron pyrite that is present in mined rock, oxidises and comes into contact with water. The mined rock either remains underground in mine shafts, or it is stored above ground in Mine Residue Areas (MRAs). Water fills up in closed/inactive mine shafts, interacting with the iron pyrite to create highly sulphuric (acidic) water (AMD). When this acid mine water reaches the surface and decants, it can have corrosive effects on infrastructure, but more pressingly, is toxic to aquatic life and communities reliant on those water sources for household and agricultural use. According to Bobbins (2015), these MRAs can result in atmospheric pollution, as well as the contamination of bedrock and soil surrounding mine sites. They may also lead to the collapse of

dewatered/rewatered ground. By 2011, the financial burden of abandoned mines was approximately R30 billion, with expected increases over time (DMR, 2010a and WWF, 2012).

AMD has affected the quality of soil and water sources, mostly in Gauteng and Mpumalanga water systems (including the Vaal, Blesbokspruit, Klip River system, Wonderfontein, Natalspruit, Tweelopiespruit, Hartebeespoort Dam, Loskop Dam and the Olifants River Catchment), where mining activity has been widespread. AMD and MRAs can contaminate soil and lower the pH to between 4 and 6, which is considered to be acidic to strongly acidic (Rösner and van Schalkwayk, 1999). This degradation of soil quality is permanent and has implications for land use in the future, limiting it to acid- tolerant plants. Heavy metals such as zinc, sulphur, nickel and cobalt are also taken up from contaminated soil by plants, and thus transferred through the food chain to humans and livestock (Ochieng *et al*., 2010). AMD also contaminates water sources and decreases the pH, with streams that run through mining areas being particularly vulnerable to contamination ((Tutu *et al*., 2008).

1.7 Rationale for this study

Research into environmental journalism and media in South Africa to date has focused strongly on aspects of environmental activism and climate change. Barnett (2003) analysed the role of media in environmental activism in Durban, and Barnett and Svendson (2002) addressed the socio-political perceptions around air pollution in Durban. Lawhon (2004) carried out discourse and content analysis of articles from a single newspaper in Kwazulu Natal province, the Natal Mercury, to characterise the rhetoric around environmental reporting in South African press. Cramer (2008) examined the media coverage of climate change in in three Western Cape newspapers in 2005, and analysed the framing around climate change and the prevalence of climate scepticism. Malan (2010) used quantitative and qualitative methodologies to assess the coverage and discourse around water pollution in Vanderbijl Park in Gauteng. Claassen (2011) investigated science communication in South African media through means of a survey of journalists and researchers working in a variety of scientific fields. A study by Bosch (2012) used qualitative assessment to investigate the reach and impact of social media to communicate

climate change while Jones (2012) examined environmental journalism through the lens of climate change media policy.

As evidenced above, the research questions and methodologies applied in these studies have been varied, although still limited in several respects; the studies which addressed environmental issues considered only climate change and air pollution. Research to date has been carried out in local contexts, with analyses focusing on provincial issues in provincial papers. To my knowledge, there is still no clear picture on coverage and content, or comparison on a national level. The research carried out thus far has given a narrow glimpse into the role and function of media in addressing environmental issues in South Africa. This Masters project therefore aimed to address this gap by combining quantitative and qualitative methods to assess coverage and content around three of the most pressing environmental issues in South Africa, and to analyse the industry trends and perceptions of journalists who report on environmental issues in South Africa.

1.8 Aim and Objectives

The aim of this study was to investigate, against the backdrop of industrial development and sustainability; what are the trends in coverage, content, voices, framing, science communication and industry- related journalistic challenges in mainstream environmental news reporting on climate change and energy, fracking and acid mine drainage; what do they suggest about the outlook for environmental communication in a development- focused, post- apartheid South Africa; where and how do these trends concretise or differ with the findings of the varied environmental journalism research efforts in South Africa, as well as internationally?

The objectives of this study were i) to assess the depth of coverage and nuances of framing of environmental news on fracking, acid mine drainage and climate change and energy in mainstream print media through a coverage and content analysis; ii) to carry out journalist interviews to identify the challenges facing environmental journalists and to gather textured, qualitative data to support and contextualise the findings of the content and coverage analysis; iii) to identify trends in environmental science communication of the three issues in print media.

Through this analysis, it is expected that the gap of information and data on environmental communication in South Africa can be narrowed, laying the foundation for further comparison on how media deals with environmental development challenges in the Global South.

CHAPTER 2: A REVIEW OF ENVIRONMENTAL JOURNALISM IN SOUTH AFRICAN PRINT MEDIA; EXAMINING THE TRENDS IN ENVIRONMENTAL COVERAGE AND CONTENT

2.1 Introduction

South Africa, like many developing nations, is faced with the challenge of addressing numerous environmental problems whilst pursuing social and economic development. Our environmental health is compromised not only by global issues such as climate change, but by local challenges of poor natural resource management, resource depletion, pollution and moderate to severe land degradation (Le Maitre *et al*., 2007). The subsequent ecological consequences include biodiversity loss, habitat destruction and general reduction in ecosystem functioning. Environmental management seeks to limit these losses and provide for the needs of society, and the research and development of effective tools for environmental management should seek to understand the environmental behaviours of individuals, communities and organisations. The environmental values, attitudes and perceptions of individuals and communities as a whole play a role in determining environmental decisions and behaviours (Dunlap *et al*., 2000). This in turn determines the resultant impact that society has on the environment and the factors which mediate effective implementation of management strategies. News media is often pivotal in shaping environmental values and behaviours through the scope of content that is put forward and the perspective and worldview from which it is rendered (Poortinga *et al.*, 2004; Fung *et al*., 2007). As such, the public understanding of environmental issues cannot be effectively understood without consideration of the effects of news media.

News media is a source of information for the public. The coverage and discourse has the potential to influence the awareness, perceptions and decisions of the public (Smith, 2013; Barnett, 2003; Scott and Barnett, 2009). Despite the events over the last two decades, both globally and locally, which have highlighted the importance of environmental awareness, the environmental coverage in mainstream news media in South Africa has been shown to be limited (Scott and Barnett, 2009).

Environmental developments in South Africa

After 1994, a number of legislative steps were taken to ensure improved environmental practices in business and industry. The promulgation of the National Environmental Management Act (107 of 1998) was followed by a number of Specific Environmental Management Acts (SEMAs) passed from 2003 to 2008. They address, amongst other things, biodiversity conservation, air quality, waste and water management, and - with the National Climate Change Response Strategy compiled in 2004 - the growing concern over carbon emissions and climate change. Internationally, the South African government also committed to international environmental conventions, ratifying the UNFCCC and adopting the Kyoto Protocol in 1997, and the Paris Agreement in 2016 (SA-INDC, 2015). The signing of such conventions and the existing and proposed Acts and regulations demonstrate Government's acknowledgment of the need for urgent action on environmental problems and improved environmental management.

Environmental issues related to industrial development and energy are linked intrinsically to the economic development of South Africa, sustainable development and thus the concept of the green economy. The substantive principles of the National Framework for Sustainable Development (2008) call for the efficient and sustainable use of natural resources and state that resources which are necessary for long-term survival should not be destroyed for short term gain. The process principles call for consultation and participation. Climate change is also highlighted in the NFSD as a major global trend to be considered, as well as the rising cost of commodities and natural resource use (NFSD, 2008). These framework principles are relevant to this research as they relate sustainable resource use, the capacity of the public to participate in an informed way and climate change to sustainability policy. The green economy is concerned with the policies and practices that will bring about sustainable development. Objectives of the green economy are at both a macro and micro level and linked to both urban and rural sustainability, for example water and waste management, green infrastructure, renewable energy use, land management and organic agriculture (Gulati, 2015). Water and energy are key components of the green economy (Gulati, 2015).
Developments around the role of business in the environment have been shaped by a push towards sustainability and social responsibility (Labuschagne *et al*., 2005; Solomon and Maroun, 2012); the first King Code on corporate governance was revised in 2002 (King II) to include

sections on sustainability and sustainability reporting, with the JSE making adoption of King III mandatory for any company listed or wishing to list on the stock exchange. The impacts of business and industry (especially mining and the petrochemical industries) on communities and the environment have brought discussions around CSR to the forefront in recent years (Neil, 2009).

The Media Role in South Africa

There is much debate over the function that media has and the role that it should play in society. Oosthuizen (2002: 43) suggests that the South African media context exhibits many of the values described by the "Social Responsibility Theory", which suggests that press is privately owned rather than government-controlled, and that media holds a level of responsibility towards society and should adhere to a code of conduct and ethics, be self- regulating and representative of a diversity of voices and views. This raises the question of the extent to which environmental media functions not only to inform readers, but also to play a role in investigating issues of concern to South African society, while representing a diversity of views and giving a platform to all sectors of society.

Science literacy is an important consideration for media when publishing articles pertaining to environmental issues. As the media plays a role in the construction of lay- knowledge, and more specifically science-related lay- knowledge (Carpenter, 2001), it subsequently has an impact on the environmental awareness of citizens and the course of action they choose to solve the environmental problems they are faced with. While specialist publications and academic journals such as *Nature* may be aimed at those already interested in science, technology and the environment, the majority of television, radio, print and online news outlets in South Africa are considered to be mass communicators and target the general public. The perception that a lack of scientific knowledge can lead to a misunderstanding of science and public apathy (the 'public deficit model'; Sturgis and Allum, 2004) must be considered by both the media, in their portrayal of scientific issues, and scientists themselves, in their communication with media and thus the public (Sturgis and Allum, 2004; Davies, 2008; Peterson *et al.*, 2009; Besley and Nisbet, 2011). Many scientists appear to believe that the major cause of the poor public understanding of

science is a lack of scientific education, followed by the effects of inaccurate and insufficient media coverage, the poor knowledge of scientific processes and a lack of interest (Besley and Nisbet, 2011). Research shows that most scientists think that radio and television, or writing for the national press themselves, are the most effective ways of communicating with the public (Besley and Nisbet, 2011). With these factors in mind, this study asked what role news media plays in communicating environmental issues that are embedded in science and development, how it frames environmental issues for the commercial news reader, and what the trends are in reporting on these issues. Specifically, I asked i) what is the level of coverage in different publications aimed at different demographic audiences and what could this indicate for environmental journalism and awareness in South Africa? How is coverage affected by big events or occurrences (in this instance, proximity to the COP conference in Durban, December 2011 is considered). ii) Which voices are represented most prominently in environmental news media and how does this affect framing and agenda- setting of the case study issues especially with regard to contentious environmental policies? iii) What is the predominant frame in environmental news and how prevalent is investigative reporting?

This study analysed environmental news reporting in South African print media, specifically focusing on reporting of fracking, acid mine drainage, and climate change and energy as case studies in environmental news media reporting. The selected issues, which are scientific and technical in nature, are also politically or economically controversial (Antilla, 2010; Tagbo, 2010; Bosch 2012) and can have harmful effects on the environment and communities. These effects however differ temporally and the risks posed by each may be perceived differently by different sectors of society, with the poor suffering greater consequences of environmental problems (Cannon and Mahn, 2010). This dynamic therefore provides a platform to understand the potential influence environmental news media has on different sectors of society and paves the way to better understanding the environmental journalism sector and how it affects the public understanding of environmental concepts and risks in South Africa. While this research is by no means an exhaustive study of the entire sector, it aimed at identifying the general trends in environmental journalism.

2.2 Methodology

The research involved both quantitative and qualitative assessments. Print media was selected as the archives are easily accessible and reliable, and representative of broad audience strata. Environmental articles on the three case study topics were assessed in five different newspapers. Coverage and content analyses were conducted.

News articles published between 01 June 2010 and 01 June 2013 which were relevant to each case study were examined. This time frame was selected for practical reasons: digital articles or archived print copies were easily accessible for this period, and the Conference of the Parties (COP) 17 was hosted in South Africa in 2011 which allowed for coverage to be compared between what was expected to be a period of high environmental focus (six months before and six months after the conference, June 2011- June 2012), and regular environmental focus (up to 18 months prior to and following several months after the conference, June 2010- June 2011, and June 2012- June 2013 respectively). In this paper, the category 'year 1' therefore refers to the period 01 June 2010 to 01 June 2011, 'year 2' to the period 01 June 2011- 01 June 2012 and 'year 3' to the period 01 June 2012 to 01 June 2013.

Newspaper selection

The newspapers were selected in order to be representative of the current South African news media market, while still providing opportunities to examine, with some depth, their environmental communication. As daily newspapers are less likely to carry in-depth stories than weekly papers are, two dailies were selected, the *Business Day* and the *Sowetan*, while three weeklies were selected, the *City Press*, *Saturday Star* and *Mail & Guardian*, to be representative of the contexts of both daily and weekly reporting. The *Mail & Guardian* and *Saturday Star* have been commended for their environmental reporting and the winning journalists of the 2011-2013 SAB Environmental Media Awards in the category of Print and Media have been reporters for either the *Mail& Guardian* or *Saturday Star* during the study period (SAB Enviro Media, 2013). Examination of reporting from these publications and journalists therefore provided insight into what the industry considers to be a high quality of environmental journalism.

The South African media industry is dominated by four main media houses; *Times Media Group, Sekunjalo IMC* and *Media24*, with the fourth, *CaxtonCTP*, publishing mostly commercial

newsprint, community newspapers and magazines. The daily papers were selected to be from the same media house, *Times Media Group*, but with different readership demographics, allowing for comparison of reporting based on socio-economic and political context (Table 2.1).

Table 2.1.
Newspaper profiles: Ownership, Readership demographic, from the Media Development and Diversity Agency (MDDA), Circulation as per the Audit Bureau of Circulations (ABC), Average issue readership from All Media and Products Study (AMPS for 2011, from the South African Audience Research Foundation (SAARF)).

News-paper	Ownership	Readership demographic	Circulation 2010	Average issue readership JUNE 2011
Daily				
Sowetan	Times Media Group	lower to middle income, black	125 490	1 618 000
Business Day	Times Media Group	middle to upper income, business class	36 110	79 000
Weekly				
City Press	Media24	lower to middle income, black	152 910	1 604 000
Saturday Star	Sekunjalo IMC	middle income, both black and white market	105 030	234 000
Mail & Guardian	M&G Media	middle to upper income, educated	50 230	383 000

Article selection

The media archive *Sabinet* was used to source articles for all but the *Mail & Guardian*, whose article database is not available online and had to be sourced from hard copies at the National Library in Pretoria. News-type articles, feature stories and opinion articles were assessed, while advertorials were discarded. Opinion articles were included as they are more likely to focus on conflict, morality, ethics and values than news and features (Nisbet and Huge, 2006) and therefore also play a role in influencing the narrative around environmental issues. For articles sourced from the digital archive, the case study topic was used as a search term. Thus for each newspaper, the articles fitting the search terms (i) 'fracking', (ii) 'acid mine drainage' and (iii) 'climate change and energy', which appeared during the study period (01 June 2010 to 01 June

2013) were downloaded and saved to a digital database. Articles which contained the keywords but did not have any environmental context were discarded. Articles which were returned in more than one search query were assigned to the topic which they most strongly addressed, or discarded if no strong relevance to any case study issue was found, and it was ensured that articles were not duplicated in the database. For the purposes of this study, articles were considered to be relevant if they directly addressed the issue of the specified case studies, or in addition, the social, economic and political issues associated with the chosen case studies.

For the *Mail & Guardian*, headlines appearing in all sections of the newspaper except the advertorials and jobs section were scanned to elicit relevant articles. Headlines which indicated an environmental article were flagged, and the full text of the environmental articles was then scanned for relevance to the case study topics. Environmental articles containing the search terms i) 'fracking', ii) 'acid mine drainage' and iii) 'climate change' and 'energy' were photocopied and added to the research database. As with the digital article selection, the articles which contained the search term but did not have any further environmental context or relevance to the environmental case studies were discarded. Table 2.2 provides a breakdown of the final count of 566 articles that were assessed for this study

Table 2.2.

Number of articles per topic in each publication from year 1 to year 3.

Newspaper	**Number of articles per topic from 01 June 2010 to 01 June 2013**			
Daily	**Fracking**	**AMD**	**Climate change and energy**	**Total**
Sowetan	2	5	4	11
Business Day	74	62	207	343
Weekly				
City Press	8	3	22	33
Saturday Star	7	48	15	70
Mail and Guardian	18	16	41	75
Total	109	134	289	**532**

Coding

To maintain uniformity and objectivity, a strict data coding process was adhered to. The emergent coding method was used, where categories were defined after preliminary data collection (as per Stemler, 2001). The coding sheet (Appendix B) and coding categories and guidelines were drawn up and information from each article was then coded in a spreadsheet. Coding was based on publication, date, word count, presence of visuals (e.g. photos, graphs etc), article reporting style, dominant content frame, actors referenced, presence of accurate description of case study topic/process, and presence of any other additional science- related explanations, and for fracking articles, whether the article presented itself as being in favour of, against or neutral towards fracking.

Primary contextual frames

This categorisation refers to the context within which the topic is placed. As indicated, the case study topics are all issues which have various risks and benefits or resolutions. Thus to understand the frame through which the issues are problematised, it was noted when classifying articles, whether the salient points of the article related more strongly to environmental, social, economic or political concerns. This categorisation draws broadly on the topic and discourse categorisation of Lawhon (2006), and formed the basis of the discourse analysis as follows:

a) Articles that fell into an ecological frame which spoke about the topic as a biological or ecological issue. These articles placed great emphasis on issues such as conservation, biodiversity or pollution and its impacts on not just society, but plant life, animals and ecosystems;

b) Articles presented in a social frame which placed emphasis on the social impacts and issues around the environmental issue. They framed the issue from the perspective of communities, human health and service delivery;

c) Articles with a business or economic angle which emphasised the economic and financial impacts and issues associated with the environmental case studies. These articles typically focused on the cost of remediation, or losses due to the environmental issues, and the potential economic gains;

d) Articles which framed environmental issues from a political perspective. They typically focused on the statements and actions of specified member of government, parliament or political parties and issues around governance and policy.

Voices

To gain an understanding of who is given a voice through environmental journalism, the individuals and sectors (hereafter referred to as 'actors') quoted in the articles were recorded. Voices (groups or individuals) were coded to represent the main actors likely to be quoted in the environmental, social, economic and political sectors. For each article the first three people or sectors given reference were coded. I took note of the first three references for pragmatic reasons, to get a quantifiable impression of which sectors are quoted and how often. Due to the journalistic style, it was also expected that the most important information usually appeared at the beginning of the article.

Journalistic style

The journalistic and reporting styles of each article were analysed. Three broad categories were defined. *Factual and informative* referred to articles which reported the facts and progression of issues with little or no analysis or further investigation. These articles typically followed the 'inverted pyramid' method of writing prevalent in most news journalism and answered the 'Five W's (who, what, where, when and why). They included a series of direct or paraphrased statements on an issue from various sectors, and provided brief summaries of previous events relating to the story. *Investigative* articles were typically written in a narrative style and reported in-depth on issues, often including research on legal, social, financial and scientific matters. *Opinion* articles referred to articles which reflected the author's subjective thoughts and perspectives on the issue.

Framing the debate on fracking in South Africa

The research sought to understand how the media frames the debate on fracking in South Africa, as the viability of fracking was still being discussed by policy makers and government at the time this research was conducted. Each article was analysed to see whether it portrayed a positive,

negative or neutral outlook for fracking in South Africa. I took into account three factors: the content of the article- how much information pertained to the negative or positive impacts of fracking; the tone- whether the word usage implied a positive or negative view of fracking, and, where relevant, the line of argument or debate- whether the opening and closing statements of the article indicated support for fracking, uncertainty over whether fracking will be beneficial or harmful or raised doubt over the overall benefit and safety of fracking.

Data analysis

The data were analysed using statistical and non-statistical methods. Means and proportions were calculated for each category where data was reported without statistical analysis. Where the research questions sought to understand the relationship between several categories, such as to identify whether year and publication were predictors for framing and frequency, statistical analyses were performed. A general linear model (GLM) with a Fisher Exact LSD Post-hoc test was carried out using the STATSOFT © (Statistica 10.0, 2010 release) programme to assess whether coverage and content variables differed depending upon the publication, and/or topic, indicating a relationship between coverage/content variables and publication/case study topics. A significance level of .05 was used for all statistical tests. Due to the qualitative nature of the study, statistical results are intended to add meaning to the contextual interpretation of the non-statistical analyses, rather than forming the basis of the interpretation of results.

2.3 Results

Coverage and demographic

Analysis of environmental news coverage in the South African media showed that newspapers associated with black readerships were less provisioned with environmental news issues. The daily and weekly newspapers associated with the white, middle-to-upper income demographic, the *Business Day* and the *Mail & Guardian*, had the highest environmental coverage (343 articles and 75 articles respectively, Table 2.2 and Figure 2.1), while the daily and weekly newspapers associated with the black, lower-to-middle income demographic and highest readership, the

Sowetan and the *City Press*, had the lowest environmental coverage (11 articles and 33 articles respectively, Table 2.2). The *Saturday Star* fell in the middle of the demographic and coverage range with 70 articles in total. When compared to the other daily, the *Sowetan*, the *Business Day* had much greater coverage (11 articles compared to 343 articles respectively, Table 2.2). In a similar trend, the *Mail & Guardian* and *Saturday Star* both had greater coverage than the other weekly, the *City Press* (with 75, 70 and 33 articles, respectively, Table 2.2). The publications with a majority black readership and lowest environmental coverage (*City Press* and *Sowetan*) also had the highest circulation (152 910 papers sold weekly and 125 490 papers sold daily, respectively, Table 2.1) and readership (1 863 000 readers and 1 651 000 readers respectively, Table 2.1). The high-coverage papers, the *Business Day* and the *Mail & Guardian* had much lower readerships (68 000 readers and 36 110 readers respectively, Table 2.1).

A GLM revealed that neither year nor newspaper were significant overall predictors of coverage ($F_{3,6} = 2.84$, $p = 0.058$ and $F_{3,6} = 0.90$, $p = 0.56$ respectively). Post-hoc tests showed the only significant differences in coverage between newspapers to be between the *Saturday Star* and the *City Press* ($p = 0.049$). However, post-hoc tests revealed that climate change and energy coverage across publications was significantly higher in Year 2 than it was in Year 1 ($p = 0.029$) or Year 3 ($p = 0.017$) - climate change and energy coverage peaks in Year 2 -Figure 2.2. This indicates that there was significantly higher coverage of climate change and energy in the time period 01 June 2011- 01 June 2012. The other topics, fracking and AMD, did not show statistically significant differences in coverage between years, however coverage of Fracking increased from Year 1 to Year 3 (Figure 2.3) and decreased over the same period for AMD (Figure 2.4)

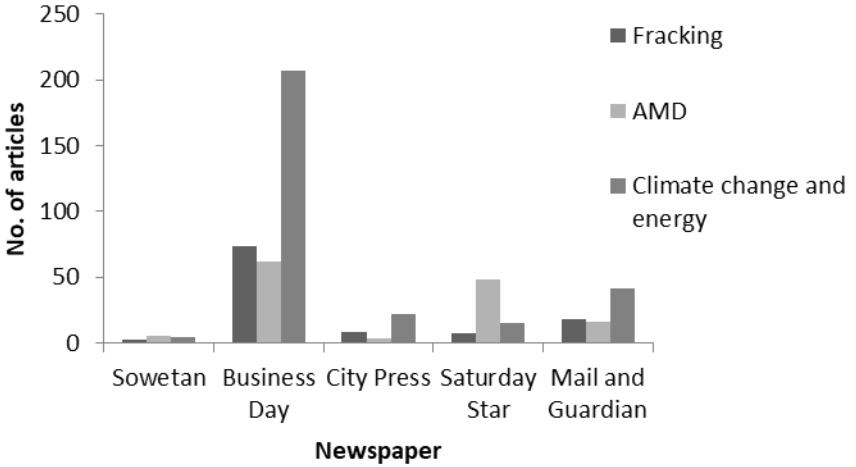

Figure 2.1 Total coverage of Fracking, AMD and Climate change and energy in each newspaper

Figure 2.2 Coverage by year of Climate change and energy in each newspaper

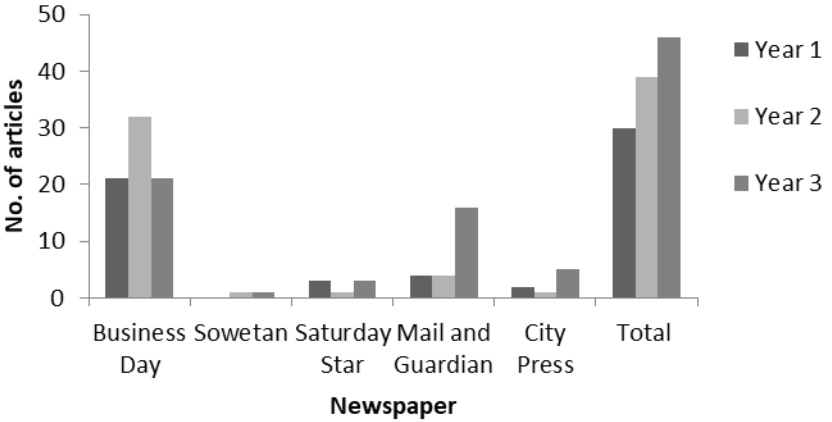

Figure 2.3 Coverage by year of Fracking in each newspaper

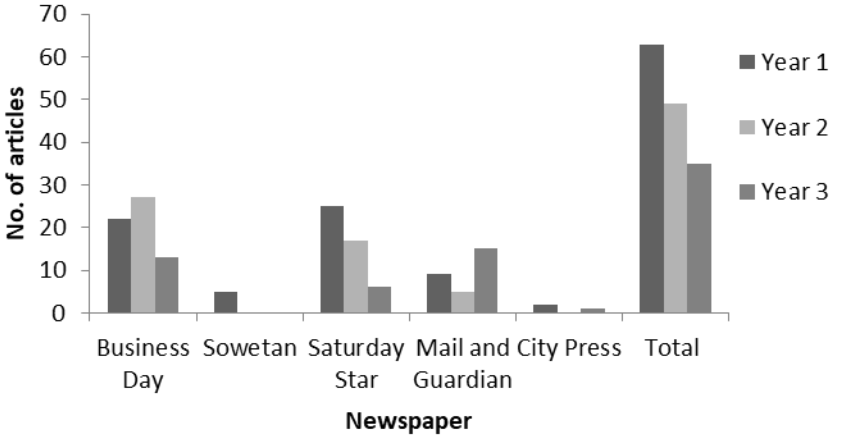

Figure 2.4 Coverage by year of AMD in each newspaper

Article length and visuals

Weekly papers the *Mail & Guardian* and *City Press* were the most likely to have visuals, with both papers including visuals in 50% or more of Fracking and AMD articles. Articles in the daily paper, the *Sowetan,* were on average between 200 and 300 words long in all categories. Those in weekly papers, and the AMD and climate change and energy articles in the *Business Day*, were on average more than 300 words long (Table 2.3). Daily papers had fewer visuals (including information boxes, explanatory diagrams and photographs) accompanying the articles; the *Sowetan* had no visuals accompanying any of its articles while the *Business Day* had 4.2 %, 6.9% and 8.2 % of its fracking, AMD and climate change and energy articles accompanied by visuals respectively .

Table 2.3
Average word count and percentage of articles which include visuals

Newspaper	**Fracking**		**AMD**		**Climate change and energy**	
Daily	**Average word count**	**Articles with visual (%)**	**Average word count**	**Articles with visual (%)**	**Average word count**	**Articles with visual (%)**
Sowetan	200-300	0.00	200-300	0.00	200-300	0.00
Business Day	200-300	4.23	>300	6.90	>300	8.20
Weekly						
City Press	> 300	50.00	>300	50.00	>300	31.80
Saturday Star	>300	0.00	>300	2.10	>300	31.80
Mail and Guardian	>300	61.10	>300	81.25	>300	70.73
Average		23.07		28.05		28.51

Reporting style

On average, the majority (over 50% in all topics) of articles in all three environmental topics across newspapers were factual and informative (Figure 2.5). A GLM found that newspaper and topic did not significantly influence reporting style ($F_{12,16}$= 0.2; p=0.996 and $F_{6,12}$= 2.49; p=0.08).

However, post-hoc tests confirmed the trend towards reporting style being more factual informative than investigative or opinion- based; there were no significant differences between the amount of opinion and investigative articles for any of the topics ($p > 0.1$, Table 2.4). However all three topics across publications displayed significant and insignificant trends towards a reporting style that is factual informative (Table 2.4, below).

Table 2.4.

p values for post-hoc Fisher test. Significant differences in reporting style in are noted in bold where $p < 0.05$ and insignificant trends (in grey) are noted where $p < 0.1$

Topic	***p* value**		
	F/I:O	**F/I:I**	**O:I**
Climate change and energy	0.088	0.058	0.790
AMD	**0.040**	0.050	0.890
Fracking	**0.007**	**0.004**	0.070

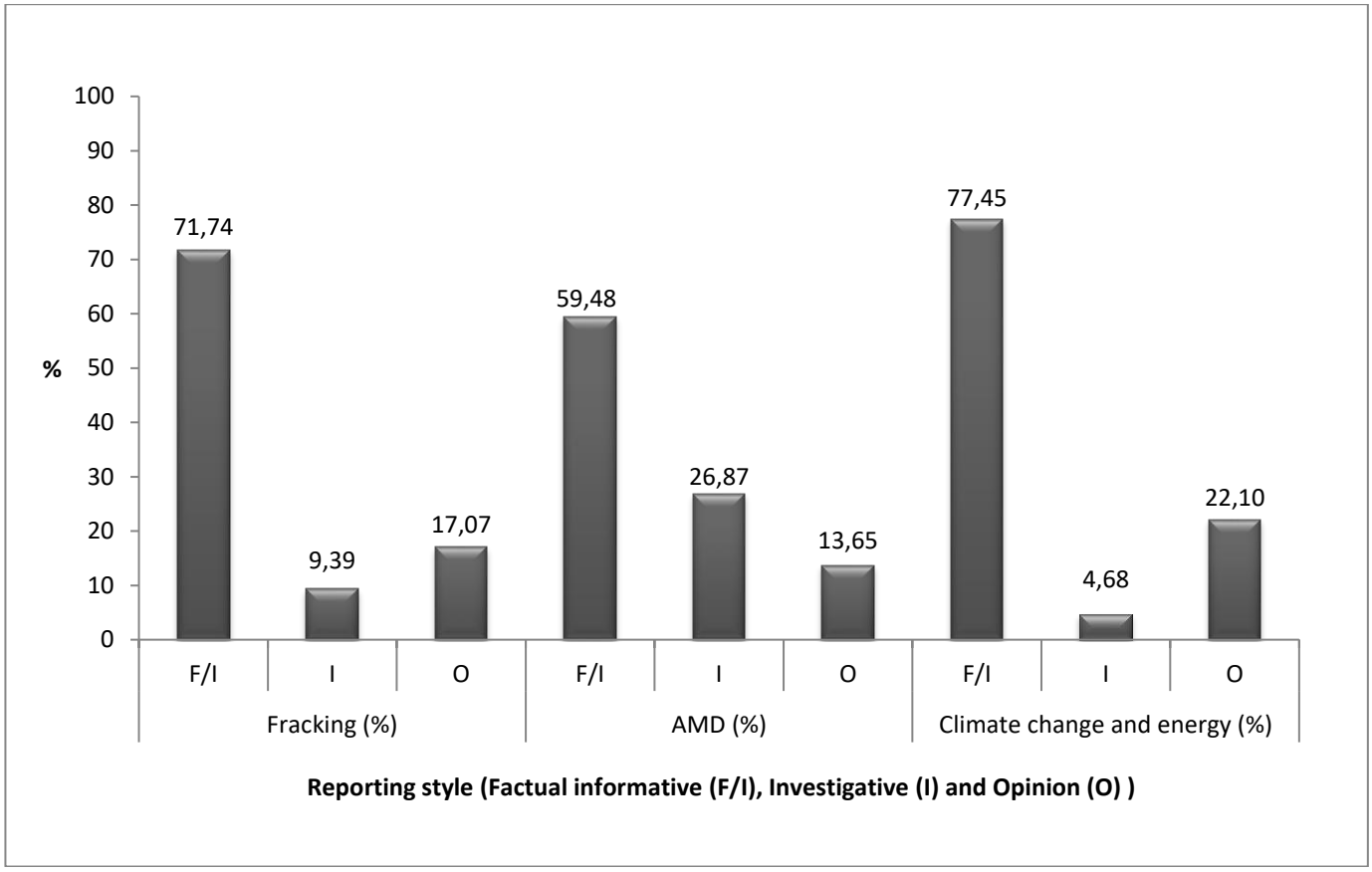

Figure 2.5. Comparison of reporting style of articles in each topic category.

Beyond the trend towards the majority of reporting being factual informative, it is worth noting that opinion articles outweighed investigative articles on topics of fracking and climate change and energy, while there was more investigative journalism than opinion articles on the topic of AMD.

Voices

Across all topics, Government was found to be quoted most often in the articles. The top five sectors quoted included Government, Business, Activist and NGO, Science and Research, and Community. Government was quoted the most (34%) while quotes from Business made up 21% of the total quotes. Science and Research voices were quoted 14% of the time. Community voices were quoted 6% of the time (Figure 2.6).

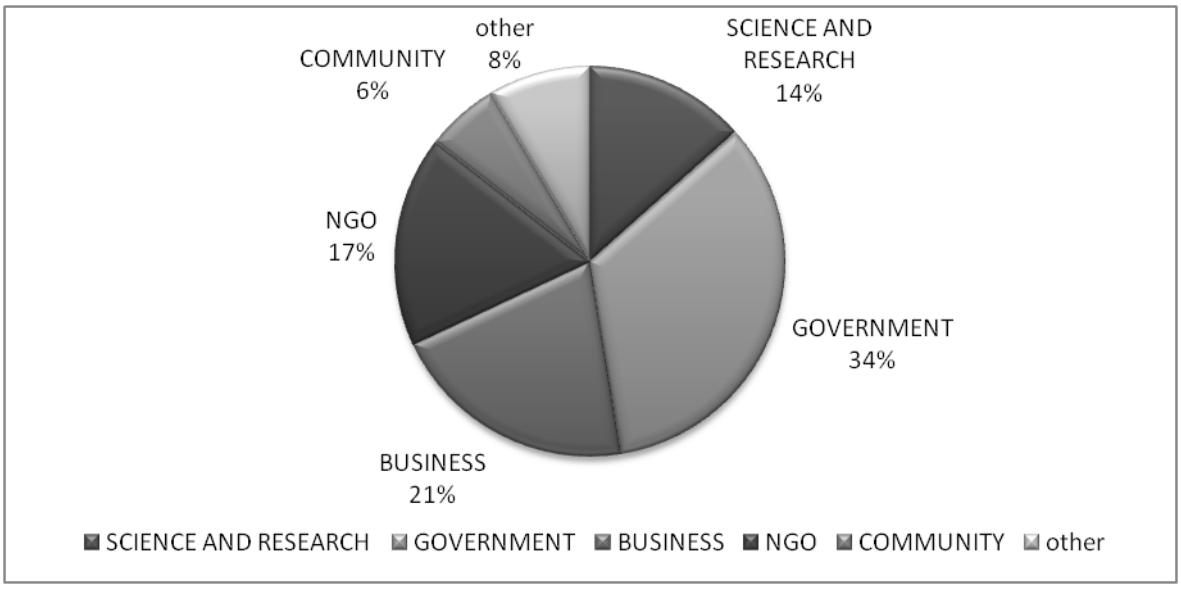

Figure 2.6: Average percentage of quotes by sector.

The majority of environmental news, across categories and publications, calculated as an average from each publication, was framed from a social perspective (48%, Figure 2.7). About 30% of all of the articles were framed from a Business and Economics perspective, and the Ecological perspective made up 8% of total news articles.

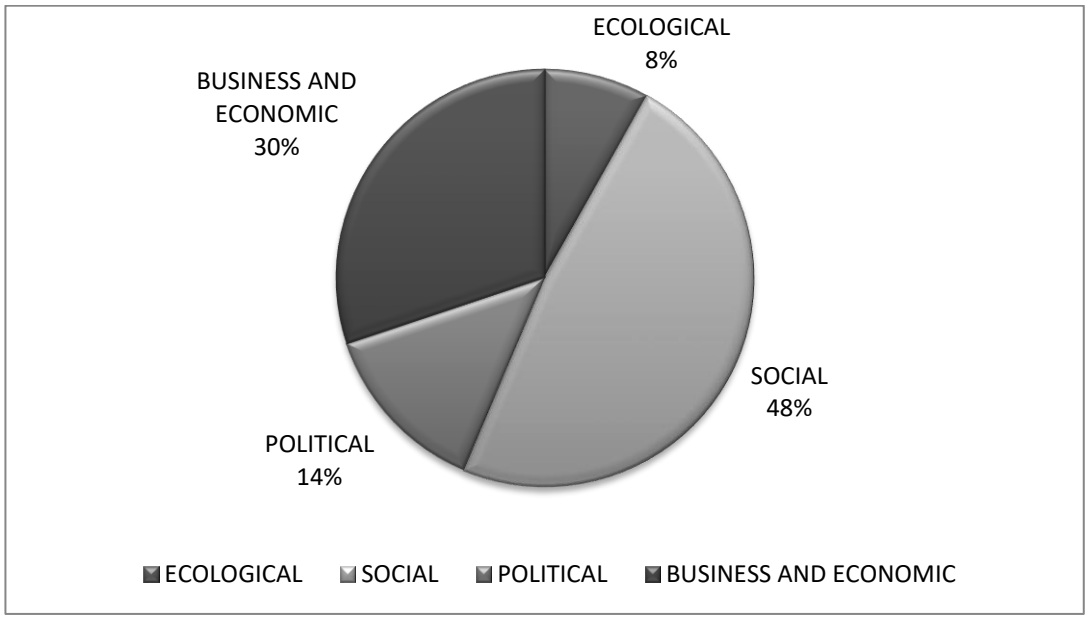

Figure 2.7: Average percentage of articles in each frame.

Framing of fracking risk

A total of 109 articles on fracking were analysed (Table 2.2), with the majority of these appearing in *Business Day* (74 articles) and *Mail and Guardian* (18 articles). The *Mail & Guardian* and *Saturday Star* showed the lowest percentage of pro- fracking articles (11.1% and 0%, Figure 2.8), while the *Business Day* noted the lowest percentage of articles that were critical of fracking (18.9%, compared to 42.9% of articles in the *Saturday Star* and 38.9% of articles in the *Mail & Guardian* which were critical of fracking). The reporting on fracking in the *Business day* was largely seen to contain information that both warned of the risks and benefits (62.2%, Figure 2.8), and had equal amounts of favourable and critical articles.

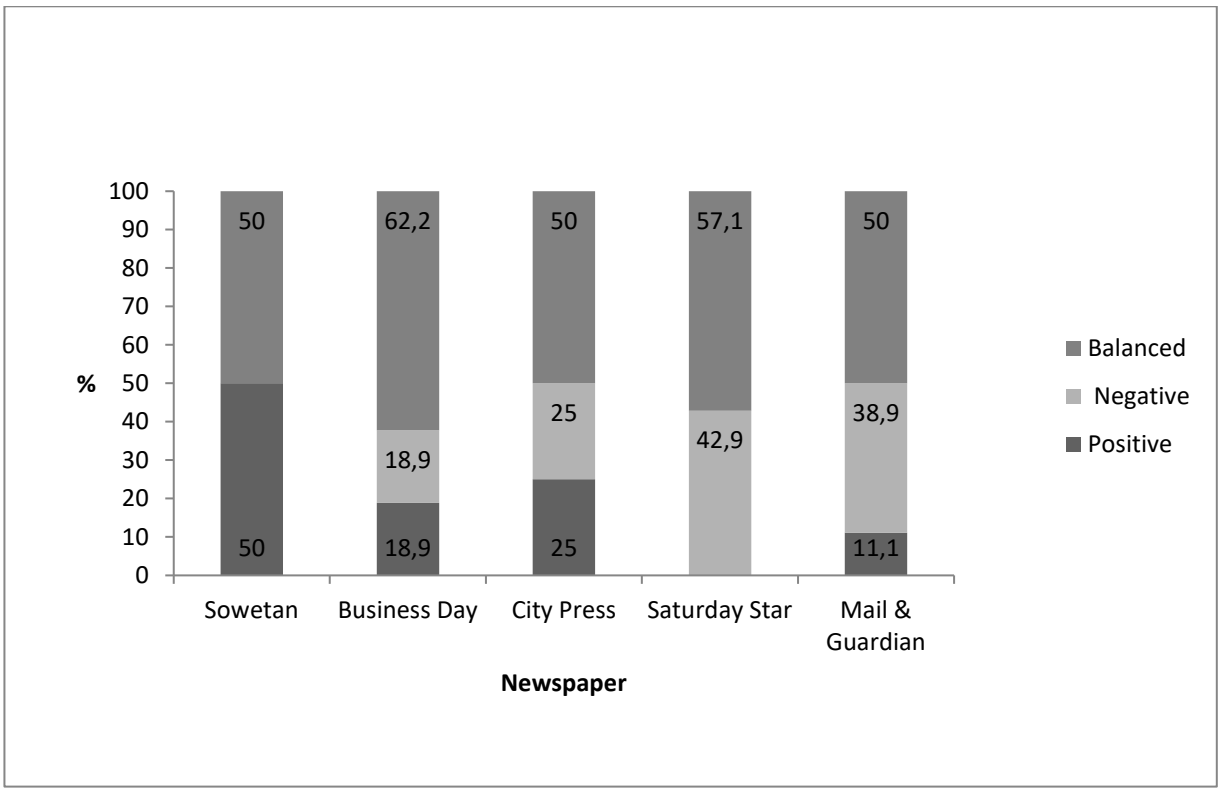

Figure 2.8: Angle of reporting on fracking.

2.4 Discussion

The South African economy relies heavily on the minerals- energy complex to generate GDP (MISTRA, 2015). Industrial activity in South Africa has left us with a number of environmental

problems, and a crisis in our energy generation. By conducting an analysis of news reporting on climate change and energy, acid mine drainage and fracking, this study has shed light on the scope and characteristics of environmental reporting on these issues and the environmental narrative influence of the media. The research further shows that environmental news coverage and quality are reflective of the highly stratified readership demographic of South Africa, and that these differences show that the way in which media ultimately foster environmental awareness and science education differs greatly from publication to publication.

The findings demonstrate firstly that there is a culture of environmental news reporting in print media. The number of articles that were specifically relevant to the three topics (532 articles, Table 2.1), indicate that acid mine drainage, fracking and climate change and energy feature as serious environmental problems on the environmental reporting agenda. The extent of this reporting varies by publication; newspapers which are consumed by a greater proportion of the public (the lower to middle income, predominantly black market) carry less news about important environmental issues than the newspapers which are consumed by a much smaller proportion of the public (the middle- to- upper income, predominantly white market, Table 2.2). The differences in coverage between the publications is indicative not only of the differing reporting focus of publications, but also of the deeper challenge of reporting on environmental issues; it questions whether it is the environmental narrative that is challenging to engage in black and lower income contexts. The finding that the two most widely read publications included in this research, the *City Press* and *Sowetan*, reported the least on crucial environmental issues, is consistent with trends identified in previous studies on the relationship between race, class and environmental discourse; Lawhon and Fincham (2006) identified that the content of environmental news media in the *Natal Witness*, at the time, framed the environment as being a white and male concern, while Cock (2004) and Scott and Barnett (2009) have reiterated the divides in the conceptualisation of the environment in South Africa and the subsequent perceived relevance to different segments of society.

The fact that there was significantly more coverage of climate change and energy around the period in which COP17 was held in Durban, South Africa, is an indicator that environmental news is often events-driven and confirms the events- driven nature of environmental news, as found in

a study by Schmidt *et al*. (2013), who used quantitative content analysis methodology to assess coverage of climate change in major newspapers in 27 countries across the world between 1996 and 2010. Newspapers in 12 developed nations (including the United States, the United Kingdom and Germany) and 15 developing nations (including South Africa, Brazil and China) were examined in the study which found that issue attention had increased globally. Building on previous research in developed and developing countries about the events-driven nature of environmental news, the study shows cover increasing cyclically depending on the events at the time, with an overall increase in coverage from 1997 to 2009. The greatest spike in coverage occurred between 2006 and 2009 (Schmidt *et al*. 2013). This paper demonstrates a similar events- driven trend for fracking and acid mine drainage. Coverage of fracking increased from 2010- 2013, while AMD coverage decreased over the same period. While important decisions on fracking were taken in 2011 and 2012 when the moratorium was placed and then lifted, media coverage of AMD had been present since at least 2002, when articles on AMD pollution on Johannesburg's West Rand were publicised in print media (Funke *et al*., 2002).

The research suggests that weekly papers are likely to give more print space to environmental issues than daily papers. Articles in weekly papers had word counts that were on average higher than those in the daily papers (Table 2.3). This could be because weekly papers have fewer time and space constraints when producing articles, and dailies tend to be smaller and present shorter articles, while weeklies can develop the information in articles. Despite these differences in structure between weeklies and dailies, investigative reporting was low across all newspapers (Table 2.4). Of the topics examined, there were in fact more opinion articles than investigative articles on issues of fracking and climate change and energy, indicating that the voices who present those opinions have a greater platform for influence on framing the narrative and risks.

Articles in the *Sowetan* were on average shorter than in any of the other newspapers, and none of the articles had accompanying visuals of any kind. However, despite the low coverage of environmental issues, the *Sowetan* is an example of how news media can play a role in environmental activism by highlighting environmental risk in its news section. From September 2010 to March 2011, the paper published four articles which reported on the threat of acid water flooding from mines in Johannesburg, and the progress made by the Interministerial

Committee (IMC) on acid mine drainage in responding to the issue ("*Department in fix over acid water*"- 02 September 2010; "*Plan to plug acid water*"- 07 September 2010; "*Year to sort out acid mine water*"- 29 October 2010" and "*Acid mine ultimatum*"- 28 January 2011). In March 2011, Government, through their media and communications spokesperson, responded by allaying fears and highlighting the outcome of the IMC ("*Govt tackles acid mine spill*"- 04 March 2011.) This demonstrates that Government recognises the influence of news media enough to see value in responding to the reports which suggested that acid mine drainage was a great threat and that government had yet to take adequate action to stop the acid mine flooding. It also suggests that government recognises the role media has in communicating environmental risk to the public. It is suggested that the media trend in South Africa, as it is in other developing nations such as China and India, is to move towards a tabloid style of local newspapers aimed at local readers, with "little or no sense of the bigger picture and no analysis" (Media Club South Africa, 2014). As the national newspapers aimed at the low- to- middle income, working- class demographic is already dominated by environmental reporting that has limited investigative content, this trend could prove to have negative effects for the development of environmental journalism in newspapers in the future.

Government voices were quoted more than any other sector (Figure 2.2), indicating that government actions, policies and statements were highly significant in the framing of the environmental news narrative and agenda. Business came second to government in setting this agenda and both government and business were seen to be the voices of authority when discussing environmental issues- not communities or scientists. When considered together with the findings that between 13.5% and 22% of all articles were opinion-based, we begin to see that media is a platform for these actors on issues of fracking, climate change and energy and AMD. This suggests a top- down flow of information, where the discourse around these issues is influenced far more heavily by government and business perspectives than community or research/ science perspectives. Similarly, Batta *et al.* (2015) undertook quantitative content and discourse analysis to ascertain the framing surrounding energy issues in three major daily newspapers in Nigeria. The study found that the newspapers had far greater coverage of issues around non-renewable energy (oil and gas) than renewable energy, whilst the discourse analysis showed that energy issues were most often framed from a business and economical perspective

rather than health, safety, technical or ecological perspectives. The study further showed that government and corporations were the most prevalent voices in the discourse, and that the majority of the articles on energy in all three newspapers addressed local issues (Batta *et al.,* 2015).

Community voices, impacts and perspectives are far from central to issues which do however have the greatest impact on the poor. Despite this, it is shown that the predominant framing of environmental news is social. Christoplos (2014), Death (2014) and Perrot (2016) all speak to the need for a shift in focus in policy and discourse from one that is top-down to one which is bottom-up and focuses directly on those affected by climate impacts and environmental risks. Further, it is suggested that the poor must be involved in decision-making and green growth policies if these are to be effective (Christoplos, 2014). This research thus shows that the environmental narrative is most greatly influenced by government and business, and ironically while it is framed from a social perspective, it does not give equal space to the voices of communities. The media reflection is that South Africa's poor and environmentally impacted are not involved in decision-making, which questions how effective the sustainability policy that underpins the green economy will be in stimulating green growth.

The majority of environmental news, across categories and publications, was framed from a social perspective (50%, Figure 2.3). The research showed that environmental news which does not have a 'human' aspect, or relevance to business or politics and policy, made up a small proportion of all environmental reporting in South African print media during that time period, suggesting that South African audiences are inclined towards an anthropogenic environmental worldview, and that interest in the ecological and biological aspects of environment remains relatively low. This concurs with the findings of Barnett and Svendson (2002), who suggested that the inclusion of more voices of activists, community members and NGOs led to a 'browning' of the environment in media, however analysis of quotes by sector in this study showed that government and business have the loudest voices on important environmental issues, while NGOs and activists are on average quoted less than half as often (Figure 2.2). This suggests that, while environmental issues are framed from a largely social or 'brown' perspective, government

and business have far more influence in media, and the environmental rhetoric in media than do NGOs, activists and communities.

Comparison between the newspapers suggests that the majority of articles are written from a balanced view point, including both the positive and negative aspects of fracking. The *Mail & Guardian* and *Saturday Star* seemed to favour fracking the least (Figure 4). The *Mail & Guardian* is well-known for its in-depth political analysis and investigative reporting (Media Club South Africa, 2014) and has been a voice for social activists since the apartheid era. As social activism is closely tied to environmental issues in South Africa (Scott and Barnett, 2009), it is in keeping with this trend that the *Mail & Guardian* would be more critical of environmental issues that, like fracking, pose potential socio-environmental risks. The *Business Day* noted the lowest percentage of articles that were critical of and openly against fracking in South Africa (Figure 2.4). The *Business Day* in fact had a greater proportion of articles in favour of fracking. It is unclear whether this tendency to carry more articles that are favourable of fracking over articles which are against fracking is a conscious effort on the part of journalists and editors, or whether it may be a result of editorial policy, the policy of ownership, or simply a reflection of the views of readership. However it does suggests that the business voice in media is more likely to favour fracking than are publications which do not have a strong business focus.

This study provides insight into the scope of environmental news coverage in South African print media; coverage tends to be dependent on the target readership and news agenda of the publications, and while publications associated with wealthier, white readerships have greater environmental coverage, publications aimed at lower to middle class markets may play a more active role in bringing issues to the attention of institutes such as government. The research suggests further that South African journalists see the environmental issues through a strongly social lens, with government and business being given the strongest voice and thus, greater influence on pertinent environmental issues.

CHAPTER 3: JOURNALIST PERSPECTIVES ON ENVIRONMENTAL JOURNALISM AND SCIENCE COMMUNICATION IN SOUTH AFRICA

3.1. Introduction

The rise of the environment as a coherent category on the global news agenda since the 1970s (Hansen, 2010) and the controversies and complexities it has presented through its portrayal of issues such as climate change, has opened the door for research into the nature of science and environmental journalism, its role in science communication and the influence it ultimately may have on shaping environmental values and behaviours (Lewis 2000; Fung and Brossard 2011). The dynamic that has driven environmentalism in South Africa is unique to the South African context (Cock, 2004), and it follows that the South African environmental news agenda is also one that is determined by this unique context. Insight into the South African journalism dynamic is vital to understanding environmental communication.

Environmental issues can often be highly complex and reporting on them may require scientific knowledge and understanding. Environmental media reporting brings up a host of other challenges to journalists, editors and newsroom structures. The communication of ecological concepts, which are generated largely by the scientific community, is not easy and bridging the gap of environmental knowledge between academics and the public, business and government, is a challenge to journalists who themselves are often unfamiliar with many scientific concepts (Besley and Nisbet 2011; Brossard and Scheufele 2013). Journalists are not only faced with the challenge of being sufficiently versed in the scientific knowledge and jargon to interpret the information, but also have to make this understandable and appealing to their audience. Contextualising environmental issues can be difficult as the impacts are not always immediately tangible, as for example in the case of climate change (Boykoff and Mansfield, 2008). Environmental news is often based on information which speaks to long-term effects or incremental changes and this adds to the difficulty of making issues relevant to the public (Reinisch 2009; Griffiths 2010). As environmental issues may pertain to several different sections of news (business, health, and political news), structuring and compartmentalising of

environmental news sections may prove difficult, requiring either that journalists are all trained to include environmental issues in their field of expertise, or that environmental journalists are able to relate their field to several others. This problem has led to what Tanner (2004, p. 360) describes as a 'passive news discovery process', whereby news is published if and when it comes to the fore, rather than through active investigation and follow- up (Reinisch 2009).

Journalists, and more specifically editors, often have many political and financial considerations in their news selection processes (Lawhon 2004; Reinisch 2009; Griffiths 2010; Painter and Ashe 2012). The impact of media ownership on newsroom goals and values, conflicting financial and journalistic goals, the relationship between commercial goals and professional values and an increase in market-predicated editorial processes have all been cited as challenges facing US media (Beam *et al.*, 2009). Despite similar pressures faced by South African editors and journalists in the news production process, it is suggested that a fair amount of independence to prioritise journalistic values exists in cases where there is a conflict of interests (Griffiths 2010).

Research on media organisations can be conducted at three different levels (Williams, 2003), the first level being that of the individual worker, where personal values, attitudes, social background, experience and professional orientation and practices have influence on the way in which news is reported (Shoemaker and Reese, 1996). The second level of organisational analysis considers organisational structures and routines and assumes that media content is shaped more strongly by the outcome of routines and policies of media organisations than by the individuals in a newsroom (White, 1950). The third level focuses on the external forces which impact on media, and the wider social, political and cultural environment which influences decision-making (Williams, 2003). Sources of information and revenue, technology and perceptions of what the audience want play a role in determining news at this level (Shoemaker and Reese, 1996). Investigation of environmental journalism practices at these three levels may help to shed light on the collective news values of an organisation, the news discovery process and the impact this has on the content and coverage of environmental news reported on in South African media.

As news in South Africa may be sourced from a single news agency across media types (*e.g.* in the past, the South African Press Association (SAPA) was used as a source by several news outlets) and due to the rise of digital media and the effects of media convergence, journalists may write for both print as well as online media, and television or radio (Erdal, 2008; Klinenberg, 2005). An analysis of coverage and content of one type of media will be relevant to the news industry as a whole. It has been suggested that organisations and social groups may experience greater media access if they understand the rhythms of news organisations and their prevailing news values (McNair, 2006). Further, structural analysis of news production such as the examination of news routines (*eg* the news-cycle, news diary, deadlines, space and time allocations) of different organisations or media types may provide insight into the likely causes of improvement or deterioration of environmental news coverage. With regards to environmental agenda- setting in the South African newsroom, Lawhon (2004) cites environmental investigative journalist Fiona Macleod suggesting in 2004 that it is the responsibility of environmental journalists to produce newsworthy stories. Fiona Macleod also launched Africa's first environmental investigative organisation, *Oxpecker's Center for Investigative Environmental Journalism*, which tackles issues of poaching, mining and climate change, amongst others.

A research gap exists in understanding the practices of environmental journalists and the challenges they face, and how this informs environmental communication in South Africa. The aim of this study was thus to conduct a series of interviews with environmental journalists and editors, who have experience in print media, in order to gain insight into their perspectives on the environmental journalism industry, the factors within and external to the news room which affect news production and the challenges to reporting and mainstreaming environmental news. To achieve this, the following objectives were set: 1) to identify factors that influence the representation of environmental issues in the media headlines, images, voices, challenges to journalists, other external influences- editors, ownership; 2) to identify the challenges that environmental journalists face when reporting on environmental news; 3) to examine the relationship between journalists, editors and ownership; 4) to examine journalist perspectives on what makes environmental news newsworthy.

3.2 Methodology

Due to the focus on environmental issues that are linked to industrial development in South Africa, when carrying out the content analysis component of this research, case studies on acid mine drainage, climate change and energy and fracking were conducted. However due to the small number of environmental journalists in South Africa, journalists working across all environmental issues were interviewed for their perspectives on and insights into their experiences of the environmental journalism industry. The interviews were carried out between August 2014 and November 2014. Purposive sampling methods were used to identify interview participants. To identify interview participants, the researcher considered journalists who had experience with working in print media and fit one of the following criteria; (1) they were employed full or part- time to write regularly for the environmental section of a newspaper, or (2) they wrote regularly on environmental issues for other media platforms. The journalists selected were thus also all South African journalists who significantly covered environmental and science news, and who had been active in print news media in South Africa over the last ten years or within the study period defined in Chapter 1 (June 2010- June 2013). At least one journalist from each of the newspapers researched in Chapter 1 was included.

Journalists were contacted by email or telephonically to arrange interviews. This list thus included journalists residing in Gauteng, Eastern Cape, Western Cape and KwaZulu Natal provinces, who had written for local, provincial or national, English or Afrikaans language publications. A total of 21 journalists were contacted; of those, 16 respondents were interviewed, and four were unavailable for interviews during the study period. Further, one journalist declined to be interviewed, citing personal reasons.

Questionnaire structure and interview protocol

The interview was semi-structured and included both closed and open-ended questions which addressed journalists' experience, the processes they follow and tools they use when writing about the environment, their perspectives on the environmental journalism industry and

challenges to reporting on environmental issues (a sample copy of the questionnaire is given in Appendix B). Previous research with environmental journalists carried out in European and American studies provided a basis for the questions set out in the interviews (see Lawhon, 2004; Giannoulis *et al*., 2010; Maille *et al*., 2010; Griffiths, 2010; Claassen, 2011). Giannoulis *et al.* (2010), in a study of environmental journalists in Greece, referred to Cox (2009) who listed five factors that set limits on production of environmental news:

- *Media political economy* –influence of media ownership and their economic interests on the news content of media source;
- *Gatekeeping and the environmental beat* –concerns the decisions made by editors and media managers to give coverage to various environmental issues;
- *Newsworthiness*- how attractive a news story is to readers or viewers;
- *Media frames* - the fundamental themes which establish and connect various semantic aspects of a news item. (Giannoulis *et al.,* 2010);
- *Journalistic norms*- the structures, tools, skills and processes employed by journalists to create and disseminate their stories.

Questions which addressed these factors were included in the interviews, and the data analysis also aimed to identify the most pressing of these issues in the South African environmental journalism context. The open-ended questions allowed participants to provide *verbatim* responses based on their own perceptions. This approach allowed for content analysis to be undertaken on the data. According to Krippendorf (2004), one of the major benefits of content analysis is the fact that unlike structured methods, it maintains the notions of the data sources.

Ethics clearance for the study was obtained from the Human (non-medical) Ethics Screening Committee (HESC) of the University of the Witwatersrand prior to commencing the interviews (Protocol Number: H14/03/21). Participant information remained confidential and none of the participants were identified by name in the study. Interviews were conducted in person; where this could not be arranged they were carried out telephonically.

Data analysis and coding

The categorical data were collated and assessed qualitatively. The qualitative responses were assessed using content analysis methodology, as described by Deacon (1999) and Krippendorf (2004). Closed- ended answers were coded according to the code sheet provided in Appendix B, while open-ended answers were organised into categories which corresponded to areas of enquiry. In the analysis of these responses, those which could be clearly identified as belonging in the same response category were coded as such, while those responses that did not share the same meaning as any other responses were given an individual code. The response data were then represented in frequency tables (where total number of journalists interviewed was sixteen *i.e.* n_{total}=16). This allowed for a realistic representation of the range of the responses and those responses which were unique, whilst simultaneously demonstrating commonality amongst the responses.

Descriptive statistics including averages, means and category percentages were then calculated for the datasets where relevant.

3.3 Results

Eleven of the sixteen journalists were female and the majority of the journalists were aged over 35 years. Nine journalists cited having at least 10 or more years of experience in the environmental field. Of the 16, 13 were white and three were from historically disadvantaged communities (two Indian and one African). Ten journalists had not completed any specialised science or environmental journalism training, with most citing that they learned through experience and entered into the environmental field through their own interest and passion. Many also commented that the scope for remaining a journalist who specialises in environmental issues is very low; gaining the experience required to specialise in environmental reporting requires financial security and time that few people are able or willing to spend. Only one of the 16 journalists reported that they were assigned exclusively to the environmental beat,

while the remaining 15 said that their reporting was not limited to environmental issues and they currently reported on other beats.

Nine journalists reported writing on all three of the environmental issues raised in the interview, namely fracking, AMD and climate change and energy, in the five years prior to the interview. Climate change was the most popularly reported issue; more journalists reported writing on climate change issues (14/16) than on fracking (12/16) or acid mine drainage issues (9/16).

Including an emotional and social angle when constructing headlines and selecting images appears to be important to environmental news journalists; almost all journalists said that environmental news which had a social aspect or affected people and communities was seen as the most newsworthy, far more so than news which related to the economic or environmental impact (Table 3.1). Journalists were also asked what factors they had taken into consideration when selecting headlines for their stories; for those who did have a role in headline selection[1], attracting the reader's attention (increasing newsworthiness) was the most important consideration when phrasing a headline (Figure 3.1). When asked what the most important factors were for selecting images that accompany articles[2], half of all journalists suggested that images are largely included to add visual detail or explanation to the story, while 31.25 % of journalists suggested that the most important function of an image was to portray a socially-relatable visual image (Table 3.2).

Table 3.1

Journalist perspectives on what makes an environmental issue or event in South Africa newsworthy

Response category	Percentage
Social impact/affects humans	**93.75**
Economic impact	**31.25**

[1] For many publications, headlines are written by the sub- editor rather than the journalist. As journalists tend to submit the articles to the editors for headlines, many of them have no say in the choice of headline, while other journalists may suggest headlines to the sub-editor, who then makes the final decision.

[2] If images are included with an article – either infographics or photographs, the journalist is likely to have a say in which image is included or have a better idea of why certain photographs are included, as the journalist and photographer may go on assignment together, or the journalists may take pictures themselves.

Environmental impact	**31.25**
Interesting, different, challenging norms (novelty)	**25.00**

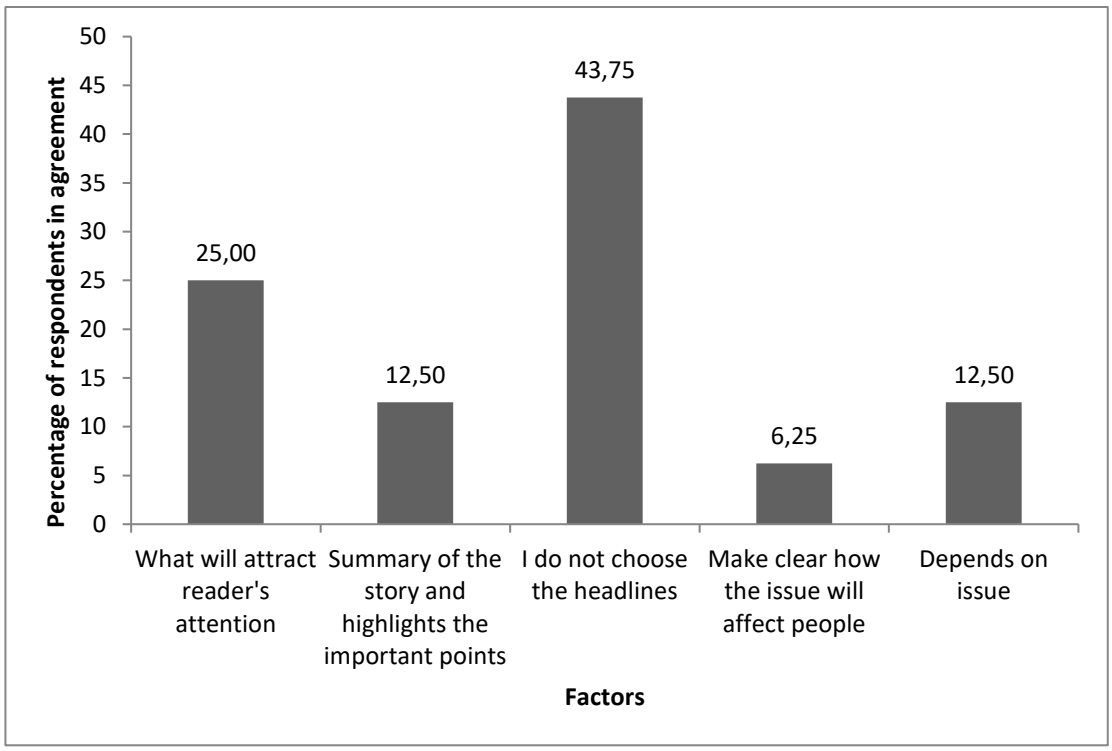

Figure 3.1. Main considerations for journalists when considering how to phrase headlines of stories.

Table 3.2

Main considerations of journalists when including images with stories.

Response category	Percentage
Practical considerations; as an aid to the story- visual representation, to add detail	**50.00**
To capture attention and elicit emotional reaction	**43.75**
Specifically to include a human face or aspect, something which will resonate with audience	**31.25**

When it came to the factors which journalists see as most important when selecting sources, the majority of journalists (87.5%) placed greatest emphasis on fairness and equal representation (including the voices of the affected parties and ensuring balance; Table 3.3). The importance of including a human face or the social aspect of the issue was mentioned by just 12.5% of respondents (Table 3.4).

Table 3.3

Major considerations cited by journalists when selecting sources.

Response category	Percentage
Inclusion of the voices of those who the story will be directly relevant to; interested and affected parties	**87.5**
Balance; including all sides/voices of a story	**56.25**
Inclusion of authoritative voices in various fields (*e.g.* a specialist in academic field, community leaders)	**37.5**
NGOs and people who regularly work with the issues in the story	**18.75**
Awareness that activists and NGOs can be biased	**12.5**
Pragmatic choices- voices of journalists' contacts in the sector	**12.5**
Based on finding 'human face (voice)' for story	**12.5**

Table 3.4

Major internal newsroom factors impacting on coverage and content of environmental news.

Response category	Percentage
Limited space for environmental issues; political and social issues take priority on the news agenda	**87.50**
Human resources- few specialist journalists and lack of journalist training	**31.25**

Advertising- difficult to run a story criticising advertisers in same issue	**25.00**
Limited financial resources given to investigating environmental issues	**18.75**

When asked how they think South Africa's environmental journalism compares with that of developed nations however, 68.75% of journalists suggested that it is resources (economic and human) that play a major role in the quality and quantity of journalism, and that as developed nations presumably have more resources; this specifically may lead to better journalism in developed countries (Table 3.5). Just over 31% of journalists suggested that developed nations have better environmental journalism.

Table 3.5

Journalist perspectives on how South African environmental journalism compares with countries in the developed world

Response category	**Percentage**
Resources play a role, developed nations have more resources and this can improve journalism	**68.75**
We are not as good	**31.25**
Differs according to environmental issue	**25.00**
SA media more objective	**12.50**
Guess that it is dependent on journalist more than industry	**12.50**
Not different	**6.25**

Journalists were asked to compare South African journalism with that of other developing nations (specifically BRIC countries[3]) and their responses showed more uncertainty; 31.25% of journalists said they were unable to draw comparisons (Table 3.6).

[3] BRIC countries were used as a starting point for comparison so as to make the comparison less broad.

Table 3.6

Journalist perspectives on how South African environmental journalism compares with other developing nations

Response category	Percentage
Not sure	**37.50**
We are on par with BRIC nations	**31.25**
Similar issues in most developing countries	**18.75**
Depends on individual journalists	**12.50**
Some developing nations have more localised content	**12.50**
We are below par compared to BRIC nations	**6.25**

Journalists were asked whether editors had ever made significant contextual changes to their articles once they had been submitted for publishing. Eleven journalists reported that their articles had never had significant contextual changes, while two journalists indicated that contextual changes had been made that did not alter the intended message of the story. Three journalists stated that they had at least one experience where the context of an article had been changed by an editor, and that these edits changed the context or intended meaning/narrative of the article (see Figure 3.2). Those who reported contextual changes were asked why their articles had been changed; one journalist suggested that the editors themselves had certain views about the issue being reported on, the second journalist suggested that the editor had misunderstood the issue or meaning of the article and the third journalist suggested more broadly that articles could be shortened, altered or moved to the back pages of publications by editors in order to prioritise social and economic-related stories.

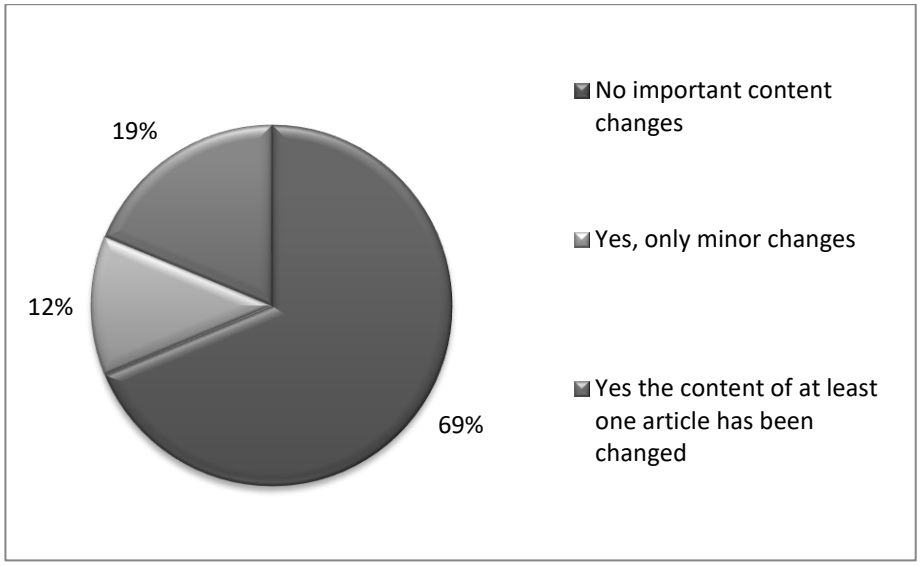

Figure 3.2. Editorial changes to the content of articles

The majority of journalists (62%, Figure 3.3) said that they thought that media ownership could influence the environmental perspectives that are put forward in the news. Responses also indicated that journalists perceived this influence may be indirect, resulting from ownership's choice of editors and subsequently the editors' values, than through direct interference or influence. Journalists further suggested that many editors come from political reporting backgrounds and thus view the importance of environmental issues differently to the environmental journalists.

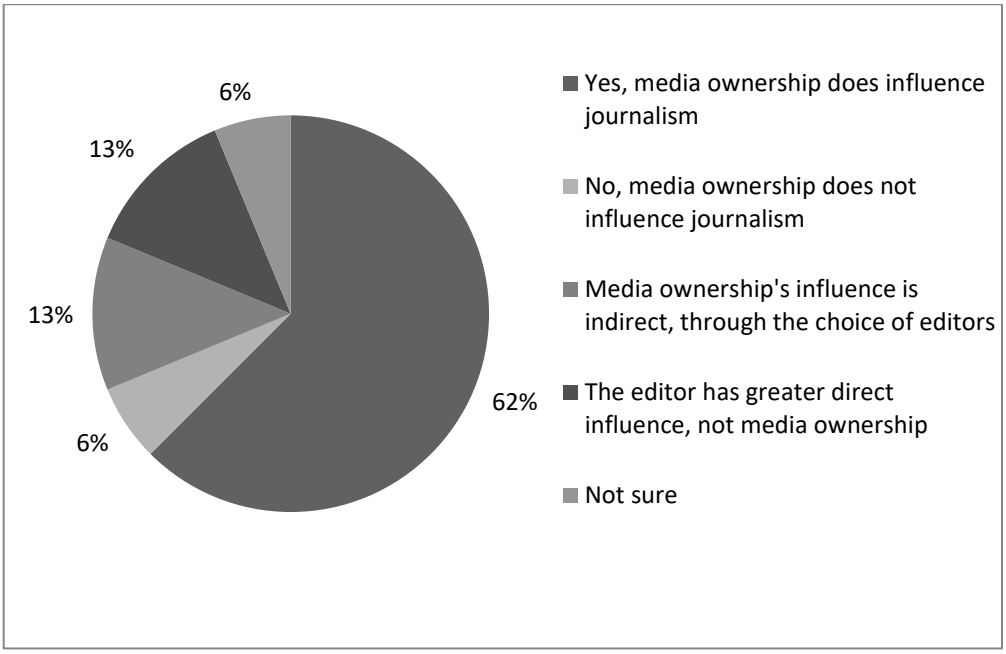

Figure 3.3. Journalist perception on whether media ownership can exert influence on the environmental values and perspectives with which environmental news is reported.

All journalists agreed that "browning" environmental issues (including human and social aspects) increased coverage. Fifteen of the 16 journalists interviewed said that they did not think that current coverage of environmental issues in South Africa is sufficient (Appendix B Table 1). The most commonly cited reasons for insufficient coverage were issues with general newsroom logistics. Two journalists attributed insufficient coverage specifically to challenges with editors, while five journalists suggested that readers' interest in environmental issues is limited (Table 3.7). All journalists said that they thought environmental issues need to be a greater priority on the news agenda. Furthermore, journalists cited needing to make readers more aware of society's impact on the environment, and the responsibility of media to report on issues as the main reasons for this (Table 3.8).

Table 3.7

Journalist perspectives on why environmental coverage is insufficient.

Response category	Percentage
Newsroom logistics- including finances, journalist training	**81.25**
Limited interest/demand from readers	**31.25**

Editors do not give enough priority to environmental issues	**12.50**

Table 3.8

Journalists' reasons for why they think environmental news should be given greater priority in South African newsrooms

Response category	Percentage
Important to make readers aware of society's environmental impact	**37.50**
Media responsibility to report accurately on environmental issues	**31.25**
Needs resources/input to develop and be kept new and fresh	**25.00**
Needs to be established as topic of concern in readers' mind	**12.50**

3.4. Discussion

The results of the journalist interviews are indicative of several trends and challenges within the South African environmental journalism industry, and place into context the broader challenges journalists face in this dynamic field. While journalists appear on the whole to be highly professional, experienced and enthusiastic, there are various challenges to mainstreaming environmental news.

From the findings of the demographic survey of journalists, trends which speak to issues of transformation are evident. Of the 21 journalists identified and contacted for interviews for this research, 16 responded and of these 16, only three were black. The majority of the respondents were aged over 35. The State of the Newsroom report of 2012- 2013 surveyed nine popular

commercial newsrooms (including the *Mail and Guardian*, *City Press* and *Sowetan*), and found that 61% of journalists (working on any beat) and 55% of editors were black. Thus the finding that there is apparently lack of young, black journalists reporting on the environmental beat in national and provincial newspapers questions the environmental media narrative, whether there are opportunities for young, black journalists to develop their skills in environmental journalism, and whether print media appeals to young, black South Africans as a space to pursue environmental reporting. The findings also bring in to question the prospects of future reporting on the environment in indigenous languages; circulation of vernacular press continues to increase, surpassing that of English- medium newspapers. The ABC reported that *Isolezwe,* a Zulu- language daily newspaper circulated largely in KZN province, increased their circulation from 104 860 to 108 629 in the second quarter of 2015, while their daily readership reached 1 180 000, with 1 150 000 additional readers of their weekend editions- according to the All Media and Product Survey (AMPS) report released in the first quarter of 2015. This is almost twice the readership of popular English-language daily in Gauteng, *The Star* (598 000 daily readers) and several times the readership of the KZN English- language daily, *The Mercury* (185 000 daily readers). Similar issues have been found by researchers in the United States, where the need for diversity in the environmental newsroom has been raised. There, sections of the media community called for environmental journalism to be more inclusive in terms of editors, journalists, voices, representation, perspectives, content and publishers, in order to ensure relevance and impact, especially to environmentally impacted communities (Society for Environmental Journalists, 2013). Given these local and international considerations and the finding that the demographic of environmental journalists in South Africa differs from the overall journalism demographic, one may argue that, as well as concerns over the environmental narrative framing, a lack of transformation in environmental journalism may be one of the biggest barriers to increasing environmental awareness of the South African public.

The results of this study showed that journalists perceive the lack of resources and capacity within the newsroom to have a negative impact on journalism, and more specifically on environmental journalism. Additionally, while environmental journalism exists as a beat in the South African mainstream media context, I could not find support to qualify the use of the term ‘environmental journalist’, as only a single journalist was assigned only to the environmental

beat, and the only dedicated environmental desk at the time the research was conducted in 2014, was that of the *Mail and Guardian*. Further, a lack of both human and financial resources was cited as a major concern regarding internal newsroom factors that impact on environmental journalism, by 31.25% and 18.75% of journalists respectively (Table 3.4). Just over 80% of journalists also cited a lack of resources as the main reason for insufficient news coverage of environmental issues (Table 3.7). Additionally, when asked to compare South African environmental journalism with that of the developed world, 68.75% of journalists suggested that greater access to resources can improve journalism (in terms of both quality and coverage; Table 3.5).

It is worth noting that the number of environmental reporters in South Africa differs significantly from the number of reporters in developed countries such as the United States. While 16 journalists were selected for the research, I could not identify more than 21 journalists in South Africa who were significantly involved with environmental journalism. Research by Sachsman *et al.* (2006) in the United States, carried out in the early 2000s, found that 46.9% of all newspapers in the 28 states studied had assigned reporters to the environmental beat and their research identified 364 reporters in just four regions of the States. This supports the journalists' perception in this study that South African environmental journalism lags behind that of developed countries such as the United States, with regard to resources and opportunities.

The print media industry is in decline, with no growth or a decline in sales reported by most publications, except the tabloids (The Audit Bureau of Circulation, 2013). This decline, due in part to a failing journalism business model in the face of online and digital news, has resulted in shrinking newsrooms, with limited funds for investigative research, hiring of specialist journalists and training (State of the Newsroom Report, 2013). Thus a lack of resources means that journalists may have difficulty in going out to investigate environmental issues, contributing to the lack of investigative journalism noted in Chapter 2. The study found that more than half of the journalists interviewed had been reporting on environmental issues for over 10 years. Sachsman *et al.* (2006) found that environmental journalists in the United States were strongly satisfied with their jobs and had spent between 13.5 and 15.8 years in the environmental journalism industry. A lack of human resources- that is experienced individuals in the

newsrooms- and lacking financial resources -further translates to fewer opportunities for internships and training with an emphasis on environmental reporting. Thus budget and funding limitations are a limiting factor in the development of environmental journalism, and thus the promotion of environmental knowledge and awareness amongst citizens.

The research suggests that environmental news is still not seen as a priority in many newsrooms; the majority of journalists cited the limited space for environmental issues due to social and political issues being given priority on the news agenda as a major factor impacting on the coverage and content of environmental news (Table 3.4). This often poses a challenge to journalists when pitching stories to their editors, which in turn affects how much coverage is given to environmental issues. Furthermore all the journalists responded that they believed that environmental issues needed to be given greater priority on the news agenda. The most commonly cited reasons for this focused on the need to raise environmental awareness and media responsibility to report on environmental problems in society.

It was suggested by some journalists that editorial preference also plays a role in setting the news agenda (Table 3.7), and that the editors themselves do not see environmental news as high- priority. This may be, as one journalist suggested, due to the fact the editors of many publications come from a political reporting background, thus have no experience in environmental reporting themselves, and tend to place greater emphasis on giving space to political and social issues. This difficulty of convincing editors of the importance of environmental stories is neither new nor unique to South Africa. Chapman *et al.* (2003) noted that many UK journalists in their study felt that environmental stories were excluded, not because they would not be of interest to their readers or viewers, but because they were not of interest to their editors. A study of environmental reporters in China by de Burgh and Zeng (2012) included statements from reporters that suggested that editors may hinder publication of certain stories. One reporter suggested that editors "[…] do not understand the news values of stories'' (de Burgh and Zeng, 2012: 16). For those involved in the environmental field, and those in the newsroom, the persistence of this phenomenon indicates the challenge that reporters face: to find more innovative ways of contextualising environmental news and bringing it in to the mainstream.

The research indicates that for the most part, journalists maintain a great degree of independence in terms of the content of their stories, including contentious issues such as fracking or acid mine drainage. While journalists may find difficulty in convincing their editors that environmental stories are important, only three of the 16 journalists interviewed reported incidents of editorial interference (Figure 3.2). Journalists however did suggest that advertorials placed in newspapers may affect when stories about certain environmental issues can be run (Table 3.4); editors may avoid running articles which criticise a company, if that company is also running adverts in the same issue. Sentiments were expressed by some journalists (not in response to any of the questions posed during the interview) that indicated that the bigger challenge to journalists who are reporting on controversial or sensitive issues may not be editorial influence, but rather it is obtaining the necessary information from companies or government, in order to publish accurate news.

In conclusion, this research aimed to gain insight into the newsroom factors that limit and influence environmental journalism. It revealed that the major challenges to environmental journalism are the limited resources available for development in the field, as well as external and internal newsroom factors which limit prioritisation of environmental news, such as the continued focus on political news on the South African news agenda, and the challenge of a lack of diversity within the pool of environmental journalists in South Africa. Finally, despite the relationship between industry and many of the environmental problems we face in South Africa, environmental reporting remains relatively independent as far as news room dynamics are considered. This research thus suggests that, while most journalists perceive that there is a need for more environmental coverage, and desire to produce more environmental news, doing so in commercial print media is likely to remain challenging due to the scale of the problems identified that limit environmental news from gaining higher priority on the news agenda. Without greater investment in environmental journalism, fundamental environmental problems cannot be mainstreamed and brought to the attention of citizens, which in turn limits the capacity to deal with environmental problems as a society.

CHAPTER 4: A REVIEW OF SCIENCE COMMUNICATION IN ENVIRONMENTAL JOURNALISM IN SOUTH AFRICAN COMMERCIAL PRINT MEDIA

4.1 Introduction

The communication of ecological concepts, which are generated largely by the scientific community, is not easy and bridging the gap of environmental knowledge between academics and the public, business and government, is a challenge to journalists who themselves are often unfamiliar with many scientific concepts (Maille *et al*., 2010; Besley and Nisbett, 2011; Brossard and Scheufele, 2013). As environmental issues are complicated and their solutions are frequently to be found through scientific inquiry, science is often viewed as the ultimate authority on solving environmental challenges (Scott and Barnett, 2009; Anderson *et al.,* 2011). Science literacy, not only of the public but of the journalists themselves, is therefore an important consideration for media when publishing articles pertaining to environmental issues. While specialist international publications and journals such as *National Geographic* and *Nature* may be aimed at those already interested in science, technology and the environment, the majority of television, radio, print and online news agencies in South Africa can be considered as generalist publications with broader audiences.

Research on science communication has largely been carried out in European and North American contexts, and from the perspective of scientists and academics rather than journalists (see Painter and Ashe, 2012; Boykoff, 2009). Literature on environmental science communication in the developing world context is rare, even more so in the South African context (Bosch, 2012) and the existing research in this area, such as that carried out by Cramer (2008) and Titus (2010), focuses solely on climate change. The need for greater research into environmental science journalism in South Africa is thus evident and this study addressed three aspects of science communication in South African print media: the prevalence of scientific explanation and information in environmental news media, the relationship between journalists and scientific authorities, and the growing role of social media in news production.

The discourse on science communication cannot be separated from the reality that knowledge construction is a multi-faceted process involving social, cultural, political and scientific dimensions (Boykoff, 2009; Nisbet and Scheufele, 2009). Successful science communication is not achieved through science literacy alone. Nisbet and Scheufele (2009, p. 1767) offer the following recommendation: "…any science communication efforts need to be based on a systematic empirical understanding of an intended audience's existing values, knowledge, and attitudes, their interpersonal and social contexts, and their preferred media sources and communication channels." This said, in a review article surveying the role of media in communicating environmental issues, Boykoff (2009, p.433) questioned "how environmental science and governance find meaning in everyday- life", elaborating that the main challenge facing media is the confusion and conflation of distinct issues, thus skewing public understanding. This is supported by previous studies on climate change by Corbett and Durfee (2004), who suggest that controversy is created through a portrayal of uncertainty, and thus greater clarity and contextualisation are needed to avoid it. While scientific literacy and factual correctness are not the only factors which determine successful communication, they play a vital role in forming public opinions about science (Anderson, 2009; Scheufele *et al.*, 2011). Thus the prevalence of science and scientific discourse in media provide insight into paradigms through which environmental knowledge and news are communicated.

The 'public deficit model' and scientist's views on science communication

The 'deficit model' has long dominated the discourse on science communication (Bauer *et al.*, 2007). It refers to the perception that a lack of scientific knowledge can lead to a misunderstanding of science, and public apathy. Although this concept has relevance and must be considered by both the media and scientists when communicating science (Sturgis and Allum, 2004; Davies, 2008; Peterson *et al*., 2009; Besley and Nisbett, 2011), several points relevant to the global scientific community have been raised regarding the understanding of scientific information, and the deficit model. Many scientists seem to believe that the major cause of the poor public understanding of science is a lack of scientific education, followed by the effects of inaccurate and insufficient media coverage, poor knowledge of scientific processes and a lack of interest (Besley and Nisbet, 2011). Scientists in the United Kingdom and the United States

reported that interviews via radio and television, or writing for the national press themselves, are the most effective ways of communicating with the public (Besley and Nisbet, 2011). Few scientists perceive there to be a problem with scientists themselves, but those who do suggest that a lack of communication skills and limited interest in science communication are the main challenges (Besley and Nisbet, 2011). Scientists may also be likely to view the public as undifferentiated - public participation can encourage scientists to view the public as diverse and not homogenous (Blok *et al*., 2008). Research by Besley and Nisbett (2011) showed that those involved with biological and environmental sciences believe their work to be more accessible to public understanding and they are also more likely to see a public role for themselves. Environmental scientists are also shown to be more likely than social scientists to view the public expectation of 'short- term' solutions to environmental and social ills as problematic. It is therefore suggested that improved scientific knowledge amongst the public may encourage greater public participation in long term greening strategies (Besley and Nisbett, 2011).

Journalists' perspectives on science and scientific authority

A study by Maille *et al*. (2010) found that a central problem in communication between journalists and scientists which affected, in the scientists' view, the quality of the science communication, was the issue of nuance and detail in scientific studies that was not reported on. Scientists expressed dismay that nuances were not reported on, and that journalists were asking scientists to make clear statements or adopt positions they did not support (Maille *et al*., 2010). Journalists however expressed that time constraints and the limits of the audience's knowledge and interest meant that nuances and details could not always be easily included in their reports. Maille *et al*. (2010) made the suggestion that scientific methodology should be included in media reports or at least read and understood by journalists to ensure greater accuracy in their reporting.

de Burgh and Zeng (2012) found that environmental journalists in China believed that one of their functions was to popularise science. The study also found that Chinese journalists believe one of the biggest hurdles when reporting on environmental science is the competence of journalists (de Burgh and Zeng, 2012). The Chinese journalists in the study elaborated that some

environmental journalists lack specialist knowledge, appropriate qualifications and do not come from science backgrounds. Some reporters argued that solutions to the problems would include hiring journalist trainees who have science degrees, and providing science training for existing journalists (de Burgh and Zeng, 2012).

In a study on environmental journalist perspectives in Greece, Giannoulis *et al*. (2010) found that the majority of reporters working with environmental issues did not perceive a lack of training in science as a problem. The study identified a type of environmental journalist described as the "scientifically-led, environmentally-responsible journalist", who accounted for 30 % of their journalist sample. This archetype values scientific knowledge and sees science as adding to their role, which they in turn perceive as being "interpreters of environmental- related knowledge". Despite this emphasis on scientific correctness, the majority of journalists in the study also believed that environmental journalism would not improve if "reporters think like scientists" (Giannoulis *et al.*, 2010, p 442), and placed importance on contextualisation of issues. The study found that reporters' lack of confidence in scientists had greater influence on their relationship with scientists and the science issues they select to report on. Existing literature thus points to the conclusion that, for journalists dealing with environmental news, understanding the facts as well as providing context and making judgements is essential (Wyss, 2008; Cox, 2009; Giannoulis *et al*., 2010).

The influence of social media

With access to the internet increasing in South Africa, new media is changing the manner in which news, and specifically science-related news, is being communicated. Around the world, increasing mobile internet access means that online news sites and social media (blogs, Facebook, Twitter and other social networking sites) are becoming important platforms for the gathering and dissemination of information and news (Bosch, 2012; Brossard and Scheufele, 2013). In an appraisal of the function of social media in communicating climate change in South Africa, Bosch (2012) suggests that, while there is overlap in coverage between print and online media, online media has the potential for more effective and direct reach. Citizen journalism is also given greater opportunity for development on online platforms, and it is further suggested

by Bosch (2012) that the discourse on climate change may have greater potential for development online than in traditional print media. Research by Harbinson *et al*. (2006) has shown that journalists often cite online sources as the most important sources of information. Research in the United States suggests that improved understanding of the effects of online media on science communication is needed (Brossard and Scheufele, 2013). One study suggests that online science news in the United States is a source of education and information for individuals who do not fall into the category of a highly educated audience that science coverage in traditional media is aimed at (Cacciatore *et al*., 2012). However, the accessibility of the digital platform is also associated with a rise in the much politicised issue of so- called 'fake news'- unverified and often biased and sensationalistic information that is spread under the guise of being legitimate news (Daniels, 2015).

Social networks are influential in shaping the spread and impact of information amongst citizens (Aral and Walker, 2012). Facebook and Twitter are the most widely used social networking sites in South Africa, according to the summary report *South African Social Media Landscape 2015* (compiled by brand and consumer research group *World Wide Worx)*. The report showed that 11.8 million people (22% of the population) in South Africa use Facebook - 8.8 million of who access it on their mobile phones. Twitter is used by 6.6 million South Africans. Both sites allow users to share and comment on user-generated content, as well as content published elsewhere on the internet. Many environmental NGOs, journalists and media houses, including newspapers, use these social media sites like Facebook and Twitter to post updates and allow readers to share and comment on articles, videos and audio clips.

Despite these advances in the access to and use of technology to spread scientific and environmental news and developments, research into the mechanisms and effectiveness of environmental science communication in South Africa is limited (yet see Lawhon, 2004 and Claassen, 2011). If media strategies of governments and NGOs are to be successful, the role that science literacy plays in science communication as well as the relationships between journalists and the scientific authorities must be understood. An understanding of the growing influence of social media may also prove helpful in paving the way forward for more focused, effective environmental science communication. The aim of this chapter was thus to gain insight into the

nature of science communication in South Africa and the influence of science communication on environmental communication. The study had four main objectives: (1) to analyse the prevalence of scientific explanation associated with environmental issues of fracking, acid-mine drainage and climate change and energy, in middle-to-high LSM, English-medium, South African newspapers; (2) to explore the relationship between environmental journalists and the scientific authorities from a journalistic perspective, and (3) to gain an understanding of the growing role that social media (specifically applications such as Facebook and Twitter) plays in environmental journalism.

4.2. Methodology

In order to achieve the objectives, the study combined quantitative and qualitative research methods. Scientific content in newspaper articles relevant to three environmental case study topics - fracking, acid mine drainage and climate change and energy - was analysed across five newspapers, including two daily papers, the *Sowetan* and the *Business Day,* and three weekly papers, the *City Press*, the *Saturday Star* and the *Mail and Guardian*. Articles published between 01 June 2010 and 01 June 2013 were analysed. Additionally, sixteen environmental journalists were interviewed between August and November 2014, and data from these interviews were included in this study.

Content analysis

For this chapter, two aspects of science communication were analysed in the news articles: whether the article included at least one sentence or statement which accurately explained the relevant scientific concept, and whether the article included any additional scientific explanation. This was carried out through the quantitative content analysis methodology described in Chapter 2; each article was scanned for content and statements relating to scientific explanation of the topic and additional scientific explanation. Where any relevant information or statements were found, their accuracy was assessed according to the criteria below, and the results were noted and analysed for each newspaper, as well as for each of the three case study topics. The study

focused on assessing the scientific validity of the explanations, rather than how many facts about the topic were included, as explanation was deemed to be more valuable in communicating scientific concepts, as scientists in previous studies have pointed to conceptual understanding as the weak point in the public understanding of science (Besley and Nisbet, 2011; Miller, 2004). Examples of topic and additional conceptual explanations from the newspapers are given in Appendix D.

The criteria for assessing the accuracy of scientific information in selected articles included the following:

Inclusion of at least one sentence accurately explaining subject*:* Definitions from the UNFCC (year), McCarthy (2011) and Vermeulen (2012) were used as comparison points for accurate explanation of the topics (climate change, acid mine drainage and fracking, respectively). Taking into consideration that word counts and constraints on space may play a role in how much explanation journalists can provide in a single article, an accurate explanation of the subject (either fracking, acid- mine drainage or climate change) was an explanation which was deemed to be scientifically sound (adhered to the scientific principles and descriptions of processes generally accepted by the scientific community); avoided complicated scientific jargon or emotive language, and provided a logical and complete description of the subject.

Additional accurate explanation of environmental processes: To gain an idea of how prevalent scientific information and discourse is in news media, it was noted whether articles included any accurate explanation of scientific concepts, other than the subject.

Journalist interviews

Purposive sampling methods were used to identify interview participants. The journalists selected were all South African journalists who significantly covered environmental and science news, and who had been active in print news media in South Africa over the last ten years or within the study period defined in Chapter 1 (June 2010- June 2013). At least one journalist from each of the newspapers researched in Chapter 1 was included. These were journalists who had experience in working with print media and fit one of the following criteria: i) they were

employed full or part- time to write regularly for the environmental section of a newspaper or ii) they wrote regularly on environmental issues for other media platforms.

Journalists were contacted by email or telephonically to arrange interviews. This list thus included journalists residing in Gauteng, Eastern Cape, Western Cape and KwaZulu Natal provinces who had written for local, provincial or national, English or Afrikaans language publications. A total of 21 journalists were contacted; of those 21, 16 respondents were interviewed, and four were unavailable for interviews during the study period. Further, one journalist declined to be interviewed, citing personal reasons.

The questions addressed to the journalists regarding science communication are provided in Appendix C. These questions were largely multiple choice questions and aimed at determining whether journalists had established relationships with academics/scientific authorities, whether they felt positively or negatively about scientists in general, and which sources of scientific information they prioritised.

Data analysis

The categorical data were collated and assessed qualitatively. The qualitative responses were assessed using content analysis methodology, as described by Deacon *et al.* (1994) and Krippendorf (2004). Closed- ended answers were coded according to the code sheet provided in Appendix B, while open-ended answers were organised into categories which corresponded to areas of enquiry. In the analysis of these responses, those which could be clearly identified as belonging in the same response category were coded as such, while those responses that did not share the same meaning as any other responses were given an individual code. The response data were then represented in frequency tables (where total number of journalists interviewed is sixteen). This allowed for a realistic representation of the range of the responses and those responses which were unique, whilst simultaneously demonstrating commonality amongst the responses.

Descriptive statistics including means and category percentages were then calculated for the datasets where relevant.

4. 3. Results

Content analysis

Each article was scanned for any description of the case study topic, and this description was then assessed for accuracy. None of the climate change articles examined in any of the publications included accurate descriptions of processes related to energy and climate change (Figure 4.1). In the remaining two case studies- fracking and AMD - less than half of the articles analysed across all of the publications included an accurate description of the topicAll publications except the *Sowetan* showed a greater explanation of fracking than of AMD (Figure 4.1).

The weekly paper *The Saturday Star* included accurate descriptions of the case study topics most often, while the daily paper *Business Day* had the fewest accurate descriptions of the case study topics (Figure 1). The *Sowetan*, despite having the lowest coverage of the environmental issues examined (11 articles overall, Chapter 1), provided accurate explanations of the case study topics for half of their fracking articles and in 60% of the AMD articles (Figure 4.1). The paper with the highest coverage, the *Business Day* (377 articles in total, Chapter 1), included accurate descriptions of case study topics in 8.43% of their articles.

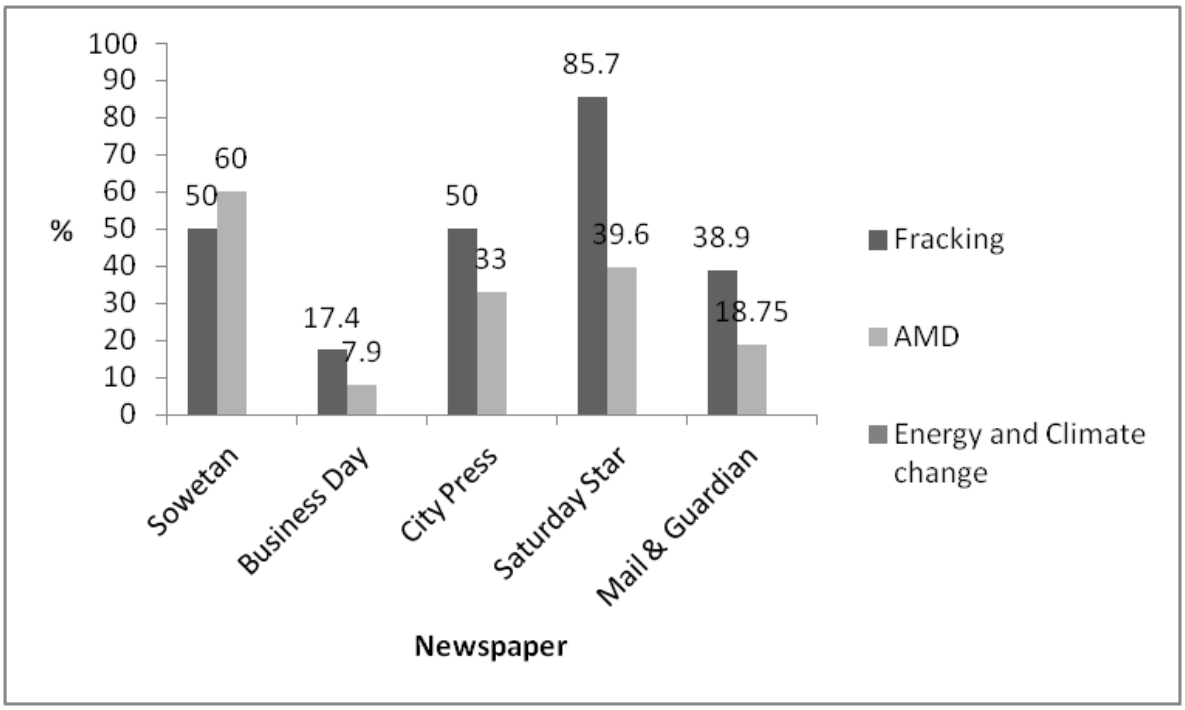

Figure 4.1. Percentage of articles which included an accurate description of the topic.

Articles on AMD were most likely to include additional explanations of scientific concepts or processes, whilst articles on climate change and energy were least likely to include additional scientific explanation (Figure 4.2). The weekly papers, the *Mail & Guardian* and the *Saturday Star,* showed greater inclusion of scientific explanation across topics than any of the weekly papers, with the *Saturday Star* showing the greatest overall inclusion of scientific explanation in environmental news articles of all the newspapers included in the study. The *Sowetan* did not include any additional scientific explanation for any of the fracking or AMD articles. Across newspapers, the *City Press* showed the greatest inclusion of additional scientific explanation in their AMD articles. Overall, articles on AMD were more likely to include additional scientific explanation of scientific concepts than an explanation of the concept of AMD itself (Figure 4.1 and Figure 4.2).

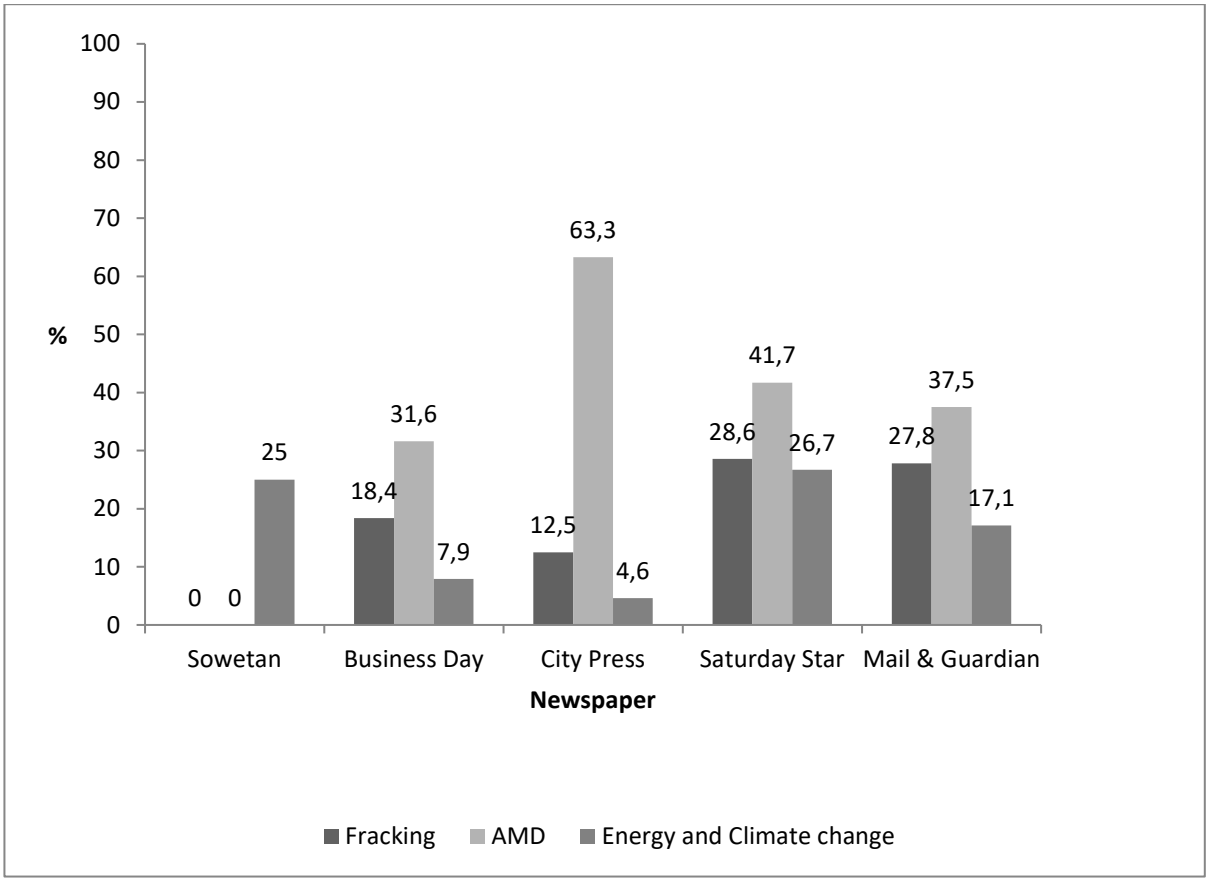

Figure 4.2.Percentage of articles which included any additional scientific information or explanation.

Interviews

All sixteen journalists interviewed responded positively when asked if they considered liaising with academics as important for science-intensive stories. However, only 68.75% of journalists said that they had actually collaborated with an academic or scientist on a story. Of all journalists interviewed, 68.75% agreed that their overall perception of academics was as helpful and approachable. Of the five respondents who did not report collaboration with academic sources, four did not agree that academics were 'helpful and approachable', citing negative experiences with some academics or scientific experts, or conveying perceptions that academics and scientific experts were difficult to communicate with. The majority (81.25%) of journalists said that they had, on at least one occasion, been contacted or approached by a scientist to report on an environment-related issue.

Of the 16 journalists interviewed, 13 responded that they do use social media for professional purposes as an aid to their journalism. Twelve of the 13 reported finding both Facebook and

Twitter useful. Three journalists believed Facebook to be more useful than Twitter, while two journalists believed Twitter to be more useful than Facebook. Eight of the journalists who reported using both forms of social media expressed no strong preference for either. An open-ended question regarding journalists' perceptions of the usefulness of social media showed that journalists perceived Facebook and Twitter to be equally useful for gathering information through the sharing of articles, excerpts from articles and links to articles. Six journalists responded that they found Facebook particularly useful for gathering information and updates about NGOs and organisations; three journalists mentioned that they found social media specifically useful for sharing information and articles and a single journalist highlighted the lack of social media penetration in poorer communities as a disadvantage.

4.4. Discussion

As a baseline study into environmental science communication in South African media, this research examined three pertinent aspects of science communication: the science literacy and level of science content on three crucial environmental issues in a sample of English-language newspapers; journalists' perspectives on scientific authority, and the usefulness of social media to environmental journalism. The results showed that science is indeed an important part of the discourse on fracking, AMD and to a lesser extent climate change and energy issues. Relationships between journalists and scientific experts appeared to be generally positive and valued, while social media appeared valuable to most journalists as a platform to gather and circulate information about environmental and science news and issues. It is shown clearly that the extent of scientific explanation and content is dependent on the environmental issue being dealt with. Articles dealing with fracking most frequently included an explanation of what fracking is (Figure 4.1). This can be explained temporally in that, as fracking is a relatively recent issue of concern on the South African environmental agenda (Willems *et al., 2016*), readers are likely to still be forming opinions and learning about the concept. Readers have had fewer opportunities to engage with the subject thus far than with subjects such as climate change, which has been reported on in some countries since the 1980s (Boykoff, 2009), or AMD, which has received media attention in South African press since 2002 (Funke *et al*., 2012).

As this study has shown that media is more likely to include accurate scientific explanations of new topics (in this case fracking- Figure 4.1), this suggests that there is recognition by journalists and media that the public may be unfamiliar with the scientific concepts pertaining to the new issue, and therefore there is a greater inclusion of accurate scientific explanation. This shows that journalists and media do indeed play a role in science communication and public education. This is further supported by the finding that AMD was associated with greater inclusion of additional scientific explanation than either climate change and energy, or fracking (Figure 4.2); while AMD is not an issue that is unique to South Africa (Johnson and Hallberg, 2005), it is not framed in mainstream news media as a global issue, as is the case with climate change and fracking. Without the global media support, local journalists may find it necessary to fill in the scientific gaps, as they cannot presume that the audience may be learning about these issues from global media.

The absence of any accurate explanation of climate change science (Figure 4.1) could be due to the complexity and scale of the issue. However climate change and energy also generally appear to be associated with lower science content than either fracking or AMD (Figure 4.2). This could be because the discourse on energy and climate change is framed more from the perspective of social, economic and political factors, thus leading to a lower focus on science than the articles on fracking and AMD which dealt with a single topic. In a study of 50 newspapers across 20 countries, including the *Business Day*, from 2004 to 2009, Boykoff (2009, p. 438) suggested that coverage of climate change has decreased in global media since 2007, and suggests that one reason for this may be that climate change issues are more frequently being treated as "energy issues, sustainability considerations and other associated themes". Due to the coverage that climate change issues have received, journalists may also make the assumption that the audience is already aware of climate change and understands the concept. This brings to the fore the issue of globalisation of news media. Fracking and climate change can be considered to be issues that are high on the local and international (globalised) media agenda. South African journalists need to be wary of this phenomenon and foster a localised media agenda that prioritises local issues in a way that is understandable to the South African public. In the context of understanding what fosters successful science communication, the issue is perhaps not one of

whether science literacy and scientific content are high or low in absolute terms, but rather whether it is appropriate for the context of the publication, and the scope of the issue being addressed.

The daily paper the *Business Day* shows notably less explanation of additional scientific concepts than the two weeklies, the *Saturday Star* and the *Mail & Guardian* (Figure 4.2). The *Business Day* also included explanations of the topic less frequently than any of the other papers, including the other daily, the *Sowetan* (Figure 4.1). However, the *Business Day* also produced a greater number of articles on each topic (Chapter 2, Table 2.2), thus as they are reporting on the issues more frequently, it may seem redundant to keep explaining issues and there may be the assumption that their readers are familiar with the science. This in itself may also be because their readership has greater access to information and education (the demographic of the *Business Day* is middle to upper income, business class - Chapter 2, Table 2.1). Despite lower overall coverage of environmental issues, the two papers aimed at lower LSM markets, the *City Press* and the *Sowetan,* included comparative levels of scientific explanation of the topic to two of the papers aimed at higher LSM markets, the *Mail & Guardian* and the *Saturday Star* (Figure 4.1). However, across topics, the lower-LSM publications were associated with less additional scientific explanation than the higher LSM publications (Figure 4.2), indicating that science may be less prevalent in the discourse of lower-LSM publications. This finding may be viewed in parallel with conversations on digital exclusion; level of income and economic agency seems to play a role in the ability of individuals to engage with technology and science (Martin *et al*., 2016; De Lanerolle, 2016) and limits access to information.

Journalists' relationships with academia

A South African study by Claassen (2011), examined the differences in perceptions of scientists and journalists about the role of science in society and science communication to the public. While Claassen's (2011) study was not limited to gathering data from environmental journalists (it included scientists in several different disciplines and journalists working with different media), survey methodology was used as the main form of data gathering, and the biggest group of scientists to respond were biological scientists while the largest group of journalists who responded to the study were those who worked in print media. Claassen (2011) found that

scientists and journalists both had a greater lack of confidence in the press than the scientific community, with scientists expressing far less confidence in the press than journalists; it was found that 24% of scientists said that they had "hardly any" confidence in the press, while just 8% of journalists described having "hardly any" confidence in the press. Confidence in the scientific community however was found to be significantly higher, with just 5% of journalists agreeing that they had "hardly any" confidence in the scientific community and 1% of scientists expressing hardly any confidence in the scientific community. Similarly, the research carried out for this paper found that journalists had a positive attitude towards science and a high level of confidence in the scientific community- all the journalists interviewed stated that they see value in consultation with experts when dealing with science-intensive issues (see section 3).

While this research has found that the majority of environmental journalists interviewed (68.75%) had positive perceptions about the approachability of scientific experts, in Claassen's (2011) study only 13% of journalists agreed that they generally found scientists, engineers and members of allied professions to be 'very accessible'. This could suggest that environmental journalists specifically have a more positive relationship with the scientific community than journalists who are not experienced or as specialised as environmental reporters. In this study, the majority of journalists reported being approached at least once by an expert to report on an issue, and this also points to generally positive relationships between environmental journalists and experts. The results also suggest that negative perceptions of scientific experts may be associated with a lower likelihood of journalists consulting or collaborating with experts (journalists who had not collaborated with scientists were more likely to have a negative perception of scientist's approachability). This however points to weaknesses in communication on the parts of both journalists and the scientific community. Indeed Claassen (2011) found that many scientists themselves were not favourable of the idea of training or regular engagement with media. This highlights the importance of developing positive relationships between journalists and experts in order to foster collaboration and consultation.

Social media

Since the advent of online information and knowledge-sharing platforms, researchers in the field of communication and social marketing have pointed to the advantages this medium could have

for spreading awareness and connecting citizens (McKenzie-Mohr, Lee and Wesley *et al*., 2011). Social media has had an undeniable impact on the spread of information and the nature of journalism, and environmental issues are no different.

Social media in South Africa is shown to be an effective additional tool for newspapers to spread awareness and encourage engagement with issues. The State of the Newsroom Report (Daniels, 2014) found that the majority of community newspapers in South Africa use social media to employ citizen participation, especially Facebook (while commercial papers tend to favour Twitter). The report also found that news consumption by South African youth is greater today than it has ever been previously, and that they are using social media- Facebook and Twitter- to catch up on news events. All of the newspapers included in the study reported using social media to break news stories and share news links. The report emphasises the importance of social media to news agencies as a way for them to increase brand recognition, community engagement and engagement amongst what the report refers to as the 'millennial crowd' (Daniels, 2014:45). The available data on social media use by and usefulness to news agencies show it to be a powerful and growing tool to spread news and awareness in South Africa, and the research in this paper agrees with these findings; while the level of engagement with social media varies, South African environmental journalists cite social media as being useful to environmental journalism. Both Facebook and Twitter were used by a majority of the journalists interviewed. Respondents noted that social media was most useful to them as a tool for keeping up with developments in the field and sourcing information in the form of articles, or links to blogs and news items. In concurrence with the findings of Bosch (2012; p. 45), who argues that " journalism (and citizen journalism) is increasingly moving to online platforms, and that the discourse on climate change may have greater potential for development in online news sources than in the traditional mainstream print media", this research suggests that widespread use of social media by environmental journalists indicates that digital media has a growing role to play in developing the discourse on science and environmental journalism, not just for climate change issues, but for a range of important environmental issues.

Across the developing world, social media shows potential as an additional tool for spreading environmental awareness. In a study of environmental journalism in the Asia-Pacific region,

Linnarz and Glaeser (2012: 7) suggest that social media may offer a solution to developing a 'pan-regional network' to develop environmental journalism. A survey of students concerned about climate change in Tripura, India, showed that while 17.05% reported contributing to articles in newspapers or magazines to voice their concerns, 27.09% reported voicing their concerns on social media such as Twitter and Facebook (Upadhyaya, 2014).

However, as many possibilities as social media presents to environmental communication, the dangers it poses must equally be negotiated by journalists and news agencies. As pointed out by Besley and Nesbit (2011), social media may also facilitate the phenomenon of the scientific community consuming, discussing and referring to only self-confirming information, which in fact limits the ability of social media to connect a diversity of people and ideologies. Brossard and Scheufele (2013) also question the extent to which the environmental articles or information that is being shared over social networks are shaped by the 'likes' and 'shares' that the article receive, which they argue could lend meaning to a story or issue over and above what the original author may have intended. The advent of social media is also argued to have had a detrimental effect on the funding models for news print and news agencies; news agencies have begun to rely on social media sites (such as Facebook) and search engines like Google to direct consumers to their online sites, which means that advertising revenues are now split (Boykoff and Yulsman, 2013).

This research has examined three aspects of environmental science journalism and found that the current quality and quantity of science in print news media is dependent on the local social context and target audience, as well as the global media context. Journalists reporting on the environment appear overall to have positive relationships with the scientific community, and journalists' use of social media suggests that online platforms are of increasing importance to the development of environmental science journalism in South Africa. This research suggests that the existing positive relationships between journalists and scientists need to be fostered, and future research should look at ways to expand collaboration between journalists and scientists. Research also needs to address ways to make the discourse and framing around environmental science more accessible, relevant and contextual to engage all of South African society. Finally, as

a way forward, it is important that environmental journalists leverage the impact of social media to increase awareness.

CHAPTER 5: DISCUSSION

This research consisted of a broad-scale examination of environmental news journalism in the South African media. What this study has essentially measured is the media response to three of what are arguably the most pertinent development-related environmental issues in South Africa. Through the use of these case studies (fracking, acid mine drainage and climate change and energy), the coverage and content of environmental issues in English-medium South African newspapers was examined. The study also took into account the perceptions of journalists, through interviews, in order to obtain an accurate and cohesive understanding of the media industry and context. This interdisciplinary approach which included the use of media studies methodologies within a scientific study, have yielded findings which begin to unravel the trends in how deeply South African mainstream media covers the selected issues, the platform it gives to various sectors to narrate the environmental discourse, the challenges and strengths of the environmental newsroom and the scope of environmental science communication in South African media. These findings include insights into the role that the media play in raising environmental awareness, the limitations on the print and news media industries, the depictions of the environment and the importance of the environmental agenda to media, and how this relates to the current state of environmental affairs and challenges facing South Africa. The key findings highlight the outcomes of Chapters 2-4 that, in terms of the coverage an issue receives, the level of science and environmental communication, and the internal industry challenges which hinder the improvement of the quality and quantity of environmental journalism, environmental issues in South Africa are not prioritised by the media industry.

5.1 Overview of key findings

The case studies on coverage of fracking, acid mine drainage and climate change and energy build on findings that point to the inequality of media coverage and representation (Lawhon and Fincham, 2004), and the challenges presented by the narrative framing of the environment (Cock, 2004; Scott and Barnett, 2009). This study found that coverage of environmental issues was greater in newspapers associated with wealthier, higher- LSM readerships, and there was

lower coverage in newspapers associated with low- to middle income, lower- LSM (and largely black) readerships. This research suggests that there is inequality in environmental coverage and depth of content on a larger scale; that the coverage and content of environmental news is still far greater in publications whose readership is wealthier and whiter, and that it is lacking in publications aimed at a lower- income and largely black market. This questions why environmental news is not a greater priority for these lower- LSM publications, which are also the most widely read.

Coverage in the period around COP17 increased in the case study on climate change and the environment, indicating that climate change coverage and thus the environmental beat also follow the media 'issue-attention cycle', this is in concurrence with Schmidt, Ivanova and Schafer (2013) who found that climate change coverage in two South African dailies had increased between 2001 and 2010 and showed the greatest increase in 2010 (pre- COP17). Investigative reporting was the least prevalent way of reporting on news issues across the case studies. Across all case studies, government was quoted most often and given the greatest voice in the issues and the majority of news articles were framed from a social aspect.

All journalists agreed that the so- called 'browning' of environmental issues increased coverage of environmental issues. Journalists emphasised that the major limiting factor of the coverage and content of articles is the lack of space (priority) that is given to environmental issues in the face of political and social issues. Journalists also indicated that they feel that environmental journalism is under- resourced. The majority of journalists said that ownership may have indirect influence on the content and coverage of environmental issues. All journalists agreed that environmental issues need to have greater priority on news agenda. Additionally, almost all journalists believed environmental coverage to be insufficient, largely due to lack of financial resources and well-trained journalists. Journalists suggested that in the case of the editor's role; most of the influence and the constraints that are placed on the content and coverage of environmental issues are due to the lack of prioritisation of the environmental beat. This indicates that journalists themselves perceive environmental issues fall short on the media beat.

These findings on lack of resources, and the need for 'brown' environmental stories are neither unique to South Africa, nor new. Chapman (1997) compared the environmental journalism and media industries of the UK and India and found that journalists in the UK noted the high costs of covering environmental issues, and cost was one of the factors cited for reporting on domestic rather than international issues. Chapman (1997) also noted that contextual issues played a role; in India, the people and stories are more concerned with local issues such as air pollution and land use than climate change. Additionally, the debate between development and environment is more pronounced in India than in Britain; UK journalists framed development more negatively, whilst journalists in India framed development more positively. Chapman (1997) also described a value split where western news values (such as impartiality) are contrasted by social advocacy journalism. Chapman's (1997) research describes people in India as having greater awareness of 'brown' (socio- environmental) issues than green (conservation) issues, whilst individuals in the UK were more aware of green issues, but that this awareness did not translate to action unless the impacts were local.

The research from Chapter 4 shows that, while science communication and explanation is present in South African environmental news media, a scientific discourse is not present in the majority of articles, indicating that science is not the determining/majority frame for environmental issues in South African news media. From the results across all case study topics in the five publications, less than fifty percent of articles included a scientific explanation of the case study topic. The majority of case studies across publications also showed less than fifty percent of articles with any additional scientific information. Within the study period June 2010 to June 2013, the news media examined did not provide any accurate explanations of what climate change is and the articles in this case study demonstrated the lowest levels of additional science content. Across publications, fracking articles were the most likely of the three case study topics to include an accurate explanation of the problem, and acid mine drainage articles were the most likely to include additional scientific information. It indicates the possibility that science framing is employed more frequently when an environmental issue is newer on the news agenda, or when an issue is more local and less global in nature. Journalists are aware of the need for liaising with the research and scientific community when working on environmental and science issues. The majority of journalists reported collaborating or consulting with scientists on

at least one occasion. Journalists believe social media, such as Facebook and Twitter as important ways to keep abreast of news and developments, network, and share articles and stories (for the purposes of environmental journalism). A single journalist highlighted the lack of penetration of social media in poorer communities as a limiting factor.

5.2. The socio- economic divides in environmental news journalism

In the introductory chapter the links between news media, socio- economic status and environmental behaviours were addressed. In the results of Chapter Two, there emerges a socio-economic divide in coverage of important environmental issues and the study shows that print media is not addressing this divide. Within the study period, 2010 to 2013, almost 20 years into democracy and around a time in which South Africa hosted COP17, environmental news coverage was highest in the middle- to upper- income newspapers (which target the middle- to-upper class of newsreaders), lower in the lower –to- middle income newspapers (which target the lower and majority classes), and seemingly not on the agenda at all for the lower – LSM, English-medium newspaper with the highest, and at the time of the study, fastest- growing readership in the country- the *Daily Sun* tabloid (which could not be included in the study as it did not carry any news on these issues during the study period). This illustrates the economic contrasts and separations that exist in South African society, and indicates that these socio-economic divisions impact greatly on environmental journalism and science communication. The communities who are reported to be most vulnerable to the issues at hand, such as climate change, are the rural poor who are heavily reliant on the environment for their livelihoods, and the urban, lower- to- middle classes (Department of Environmental Affairs, 2011). This segment of society is more broadly defined by the IPCC (year) within the context of socio-economic inequality. In their 2014 report on climate change they describe the vulnerable as *"*People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized", where vulnerability is said to be "the product of intersecting social processes that result in inequalities in socioeconomic status and income, as well as in exposure..." (IPCC, 2014, p6).

Thus the segment of society who are at the greatest risk to the impacts of poor environmental health, are also those who benefit the least from environmental education and the

communication potential that news media has. News media contributes to the knowledge and values of a society and can have an impact on the environmental behaviours of individuals and organisations (Lewis, 2000; Fung *et al*., 2011). This gap in the communication of environmental news may contribute to the perceived distances between human society and the environment, where the 'distance' or externalisation of the environment and reliance on ecosystems is pointed out by Cock (2004) to be a limiting factor in environmental activism and awareness. As a lack of coverage can translate into the perception that an issue is not of high social priority, it may also contribute to the current discourse around the environment that perpetuates the idea that the environment is the concern of the 'wealthy and white elite', when it is the poor who suffer the consequences of a degraded environment. These factors may subsequently limit the effectiveness of the policy, business and social interventions that have been and are yet to be implemented to address environmental challenges.

At this juncture one may return to the issue of environmental justice, and its importance as an environmental frame, but especially as one that has relevance to poor and marginalised communities. The end of apartheid also stimulated development in the way in which 'the environment' was conceptualised, broadening the concept of ecology to "include the living and working space of black South Africans" (McDonald, 2002). Environmental justice articulated the common goal for many environmental NGOs, many of which have been key role-players in bringing polluters to task and dealing with issues of water and air pollution, food security and renewable energy (Hallowes, 2011; Martinez- Alier, 2001). Since the end of apartheid, the environmental discourse has moved towards being more strongly people-oriented, with a focus on the relationships between pollution, poverty and political and economic exclusion. The value of social movement activists as sources for environmental journalists has reportedly been enhanced due to this shift in focus (Barnett and Svendson, 2002).

Socio-economic inequality has further implications for environmental journalism. In Chapter 4 it is shown that for the majority of journalists interviewed, social media such as Facebook and Twitter are clearly an important way to keep abreast of news and developments, network, and share articles and stories. However, suggested by a single journalist as a comment on social media usefulness, was that there is lower penetration of smartphone technology and social

media in rural and poorer communities, and this limits the use of social media to generate and spread credible news in vulnerable communities (Appendix D). This statement has relevance not just to the usefulness of social media, but to the future of environmental journalism and environmental science communication; news media migration to digital platforms is increasing (with most newspaper companies reporting a digital- first strategy -Daniels, 2014), but the costs of mobile handsets and data remain relatively high.

Research on mobile technology in sub-Saharan Africa supports this suggestion; smartphone penetration is increasing in the South African consumer market; 23% of all mobile phones were smartphones as of 2014 (GSMA, 2014) increasing to 25% in 2015 (GSMA, 2015), and expected to increase to 50% by 2020 (GSMA, 2015). Despite this, the biggest researcher on mobile technology in Africa, states that due to the high cost: "[…] such devices remain unobtainable by the vast majority of the population." (GSMA, 2014:34),and reiterated in GSMA (2015:10) "Affordability remains a key limiting factor for many consumers in the region, especially poorer rural dwellers who still struggle to afford data-enabled devices and tariffs, despite falling prices." This once again underlines the contrasting ways in which science communication can be effective in its reach. While digital and social media may be useful to journalists reporting in urban, middle- to- upper LSM contexts, to spread news in the form of articles and links to video or audio content on the subject, this research did not investigate in what ways social media is effective for journalists in different social contexts. Further investigation is needed to understand the potential of digital environmental journalism in lower LSM contexts. The 2014 GSMA report also highlighted that "content and services that are relevant, accessible, and available to the users in their own language will be crucial in bringing the full benefits of the mobile internet to users" (GSMA, 2014:37). Since the study does not include community newspapers or vernacular press, future studies on coverage and content in community newspapers, and fast-growing vernacular newspapers such as *Isolezwe* may help to further understand the extent of this coverage gap. However the identification of these socio-economic divides ultimately questions the role and responsibility of media to society, and the role of editors and journalists, in informing and educating the public about the environmental issues which affect them. In Chapter 3, we see 15 out of 16 journalists expressing that they personally believe that environmental coverage is insufficient. Given the importance of news media to raising environmental awareness, this

research motivates for greater development of the environmental beat, especially in lower- to-middle LSM publications.

5.3 From Green to Brown- a changing narrative in environmental journalism?

Having identified the coverage gap, this research also sought to understand the underlying dynamics and influences on media coverage, by means of quantitatively and qualitatively investigating what makes environmental news 'newsworthy'. From a content assessment of articles in Chapter 2, it is seen that majority significant portion (50%) of environmental news across the case studies and publications, between July 2010 and June 2013, was framed from a social perspective (in summary, from an anthropocentric perspective of the impacts on, or relevance to, communities and society). Just 7% of news was found to be framed from an environmental or 'green' perspective (where emphasis is placed on the impacts of flora, fauna and wildlife conservation). This corresponds with the responses from journalists; the majority stated that news framed from a social angle or with a social impact is the most newsworthy and when asked through an open ended- question what their main considerations for the visuals accompanying articles are, 44% of journalists replied that visuals should ideally capture the attention of readers and elicit an emotional response. Furthermore, the majority of journalists responded that they agreed that the 'browning' of environmental issues increases the coverage they receive. The findings thus suggest that articles which discuss issues in a manner which taps into human empathy, and contextualises the impacts of environmental issues on society, are the most newsworthy, and more likely to be published, and that journalists are aware of this.

These findings differ from the few analyses that have been carried out on environmental media in South Africa, most notably the findings of Lawhon and Fincham (2006) and Cramer (2008). Lawhon and Fincham (2006) surveyed all environmental articles published in the *Natal Witness* between August 2003 and July 2004 and found that across all articles, the most prevalent themes were 'green' (48%), far more prevalent than the number of articles containing 'brown' themes (17%). Cramer (2008) surveyed all articles pertaining to climate change in three Western Cape dailies, the *Cape Argus*, *Die Burger* and the *Cape Times,* between January 2005 and December

2005 and found that the majority of articles on climate change were framed from the perspective of the impacts on the flora and fauna, or from a 'green' perspective. These two studies and this research project used different methodologies, with each examining different aspects of environmental media. Although this study focused on environmental issues which perhaps by definition focus more on the social and human impact (for example, limiting the research into climate change as 'climate change and energy', where 'energy' is inherently a 'human' problem), this research has looked at a greater number of publications, and over a greater period of time. The definitions of what constitutes 'brown' and 'green' journalism were consistent across all three studies. That the majority of news examined in this research was framed from a 'green' rather than 'brown' perspective, whereas the majority of news in previous studies found the opposite to be true, highlights a change in the way in which environmental news is being reported, and consequently a change in what can be seen as being 'newsworthy'. It appears that reporting has evolved since Lawhon and Fincham's (2006) study of media in 2003 to 2004, and Cramer's (2008) study of media in 2005, from being focused on 'green' issues, to involving greater context on the social impacts and relevance in this broader study of environmental journalism in 2010 to 2013. These findings are also supported by Cock (2004) and Scott and Barnett (2008) who have previously discussed the reframing of environmental challenges in South Africa from 'green' to 'brown' issues, and suggests that this reframing in the sphere of environmental politics and activism may also have contributed to 'brown' issues becoming more newsworthy. Future studies may look at further investigating changes in the narrative and framing of environmental news in South Africa over the past decade, as well as the factors that have mediated this change.

5.4 Science communication in environmental news and who speaks for the environment

In this study, content analysis revealed that government voices are the most prominent in the articles (37%), indicating that government, rather than community (7%), business (21%), science (16%) or NGOs (19%), is seen or projected as being central to the discourse on these three environmental issues. Similar findings came from Lawhon and Fincham (2006), who found the highest number of quotes across all environmental issues to come from government (19%; p115, Table 2), while Cramer (2008) found that the most common voice (noted in her study as a

'source') in climate change articles were scientists (25%), followed by politicians (17%). Direct trend-lines cannot be drawn between the studies as the methods differ, however the prominence of government in all three studies shows that over the past decade, on climate change and various other environmental issues, government is given the loudest voice.

Despite the seeming move from using green frames when reporting environmental news, to using brown frames and themes, community voices still remain far quieter than government, scientists and business. It is also of relevance at this point to note that, in this study, investigative reporting which involves a level of analysis and novel discussion, was far less prevalent than factual reporting or opinion pieces (Chapter 2). Future interviews with journalists and editors may want to address whether there is a link between the lack of investigative reporting, and the low numbers of community voices and sources, especially in light of journalists comments on the limitations that a lack of resources puts on the quality and level of investigative journalism (also supported by Cramer's (2008) findings, as discussed in Chapter 2).

The prominence of government voices also has relevance in light of the findings on science communication in environmental news media. News media is an important source of environmental information and knowledge for the public (Wilson, 1995, 2000a, b). Due to the scientific and academic nature of knowledge around environmental issues, such as climate change and fracking, science communication is an important part of environmental news and communication (Fischer, 2003; Shanahan 2009, Scott and Barnett, 2009). Thus accurate science communication that relates factual information about the risks these issues pose to human and ecological well-being is important to public participation and decision-making. This study found that scientific discourse, though present, was not employed in the majority of articles to explain the environmental issue, nor was any other accurate scientific discourse/ reference made in the majority of articles. The scientific discourse was most notably low or entirely absent in articles on climate change and energy. When one considers also that government voices (37%) are more than twice as prominent as the voices of scientists (16%) and business is given a greater voice than scientists (21%), it suggests that South African news media does not defer as much to science, as it does to government, reiterating the central role that government appears to play in the environmental media discourse.

5.3 Conclusion

News media is an important determinant of environmental knowledge and values and thus environmental behaviours and decisions. This study not only adds to the understanding of media, but ultimately how it affects the values and knowledge of individuals and the South African public. This study has achieved the objectives of investigating environmental media in terms of the coverage and content of three important environmental problems facing South Africa. It has identified that despite the effects of climate change, acid mine drainage and fracking on the poor, environmental reporting is weaker in lower LSM publications, and that much as it is in other developing countries, the industry faces challenges in the form of a politics-dominated news agenda and limited financial and skilled human resources. The study also identified what seems to be a narrative transition from green to brown reporting of environmental events, as predicted by previous studies, where the social aspect of environmental news is increasingly used to frame environmental problems. Science is also shown to be an integral part of the environmental discourse on these issues, but despite this- it is government and not the scientific authorities or communities who are projected as being central to the discussion of these issues in media. These trends highlight both the weaknesses and strengths of the environmental journalism industry and the future of environmental journalism, showing the dynamism of the media industry. Finally, this research motivates for further investigation into this important mediator of environmental behaviour, specifically into community- based and vernacular news media reporting on environmental issues.

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Appendix A

1. Examples of descriptions of fracking and AMD.

1.1 Fracking

1. "[…] *shattering the shale by pumping water into it at a high pressure"*

(from "Pasa 'will be impartial' on shale gas applications", 17 March 2011, *Business Day,* written by Political Correspondent, Linda Ensor)

This explanation was considered scientifically inaccurate and insufficient as it does not provide enough information, and also runs the risk of creating misleading or emotive imagery with the use of the word 'shattering'- possibly implying that the rock is glass- like and fragile.

An example of an accurate description of fracking is the following:

2. *"Fracking is the common term for hydraulic fracturing which involves pumping a pressurized mixture of water, sand and chemicals down drill holes to fracture shale and release ga*s"

(from "Provinces farmers fear another Mpumalanga", 17 June 2011, Business Day, written by Development and Environment editor, Sue Blaine)

1.2 Acid mine drainage

An example of an accurate scientific description of AMD would be:

3. *"[..] This refers to the highly toxic and radioactive water seeping from the underground voids of abandoned or closed mines. It arises when the sulphide- bearing mineral iron pyrite is exposed to oxygen. The process is enhanced when water moves through and over acid bearing rock exposed through mining activities. The result is contaminated water, poisoned with heavy metals, a low pH, and high levels of sulphates, and potentially radioactive material."*

(from "Mystery of rising water baffles all", 21 May 2011, the *Saturday Star,* written by Sheree Bega, environmental journalist).

While an example of additional accurate scientific explanation on the topic of AMD follows;

4. "The proposed neutralisation (high density sludge) of the AMD as a short term and immediate address is not best practice, it is ineffective and will result in adverse impacts upon the ecology and downstream water users and uses"…the gypsum process which involves using lime to neutralise the acidity of the water and remove toxic heavy metals.."

(from "Environmental group threatens to sue authorities if acid mine drainage not cleaned up, criticises proposed neutralisation", 18 February 2012, the *Saturday Star,* written by Sheree Bega, environmental journalist).

Appendix B: Code Sheet

1. Basic quantitative information

1.1 Visual

-Yes/No

1.2 Word count

A) <100 words
B) 100 to 200 words
C) 200- 300 words
D) More than 300 words

2. Qualitative information

2.1.1 Primary contextual frames

1) Environmental issues/justice/ policy
2) Social justice/ social policy
3) Economy/ economic policy
4) Politics

2.2.1 Actor (Referenced as individual)

13) Scientific/academic expert
14) Activist/NGO
15) Politician/ member of political party or parliament/ government
16) Lawyer/legal
17) Business person
18) Concerned/involved citizen
19) Other
35) Journalist

2.2.2 Actor (Referenced as group/organisation)

20) Government/Government department
21) Business
22) Society
23) Research/academia (private)
24) NGO
25) Civil society
26) Political Party
27) Parastatal/SOE/State- affiliated organisation.
28) Other

2.2.3 Type of reference

10) Direct quote from speech/interview
11) Statement written/ submitted by actor
12) Paraphrased from speech, interview or statement

2.3 Fracking

-Positive
-Negative
-Balanced

2.4 Inclusion of at least one sentence accurately explaining subject

-Yes/No

2.5 Additional accurate explanation of environmental processes

-Yes/No

2.6 Journalistic style

-Factual and informative
-Investigative
-Opinion

Appendix C- Sample interview questionnaire.

Section A

Is your reporting currently limited to environmental issues? If not, what other topics do you report on?

1 Yes No _____

_____

2 How many years of experience in environmental reporting do you have?

0- 5 years | 5- 10 years | 10+ years

3 Have you completed any specialised training in environmental/science reporting?

None | Special course | Diploma | Internship | Degree

4 Have you reported on news relating to any of the following issues in the last 5years? (circle)

Climate change | Acid mine drainage | Fracking

5 Approximately what proportion of your environmental articles are sourced from other news agencies (SAPA, Reuters et cetera)?

_____

_____

Section B

6.1.1 How do you choose the headlines for your environmental stories (what factors do you take into consideration)?

6.1.2 How do you choose which sources to speak to?

6.1.3 How do you decide what images to include/will be relevant/understandable?

6.1.4 Have many of your stories changed at all between being submitted and being published?

Yes No

6.1.5 If yes, in what way?

6.1.6 If yes, why?

6.1.7 What makes an environmental event in South Africa newsworthy?

6.1.8 How does social media impact on the way you report environmental events?

Section C

7 Do you collaborate with scientists/academics on any of your stories?

---

8 Do you perceive academics to be helpful and approachable?
Yes No

9 Have academics contacted you to report on an issue?

---

10 Do you think it is important to liaise with academic sources when reporting on news that is knowledge- intensive?
Yes No

11 When carrying out research for articles, which of the following would you be more likely to consult (or quote) for technical/scientific information?
An expert Wikipedia Scientific journal article

Section D

12 What do you think of the (mainstream) media's coverage of environmental events (sufficient; Insufficient, why)?

13 What internal newsroom factors impact on the coverage and content of environmental news?

14 Do you think that media ownership can play a role in influencing the perspective with which controversial issues are reported on?

15

Do you think it is challenging to communicate environmental and scientific concepts to readers whose first language is not English?

16 How do you think the quality and coverage of our environmental reporting in SA compares to that of developed countries such as the US?

17 And similarly to other developing nations (*e.g.* BRIC)?

18 Do you think that environmental news needs to be a greater priority in SA newsrooms?

Yes No

18 Why?

19 Do you think that "browning" environmental issues will increase environmental coverage and give more coverage to issues which affect a greater proportion of SA?

Appendix D- Additional results

3.1 *Respondent (Journalist?) demographics*

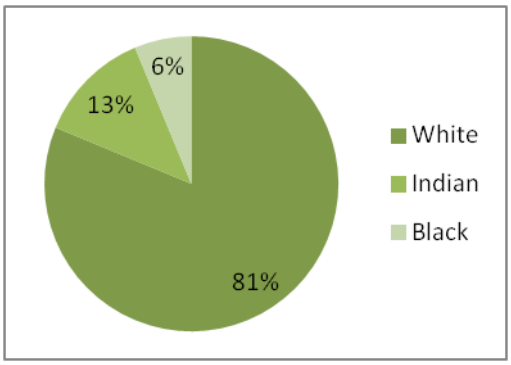

Figure 1 Race of journalists interviewed. Most environmental journalists interviewed are White (81%).

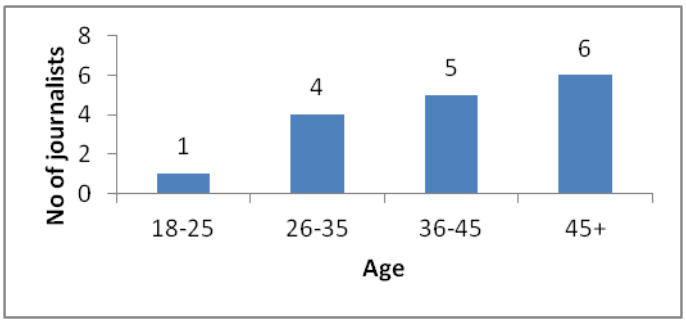

Figure 2 Age distribution of journalists. The majority of journalists were over the age of 35 (68.75%).

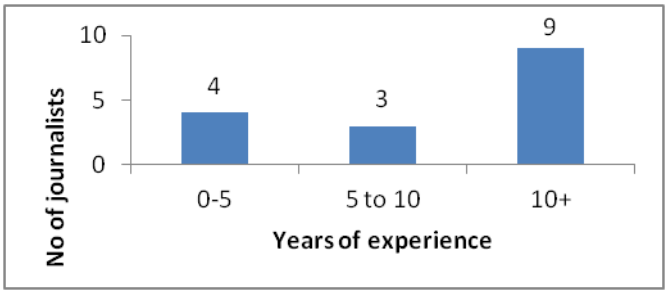

Figure 3 Years of experience in environmental journalism. Most journalists had 10 or more years of experience in environmental journalism (56.25%)

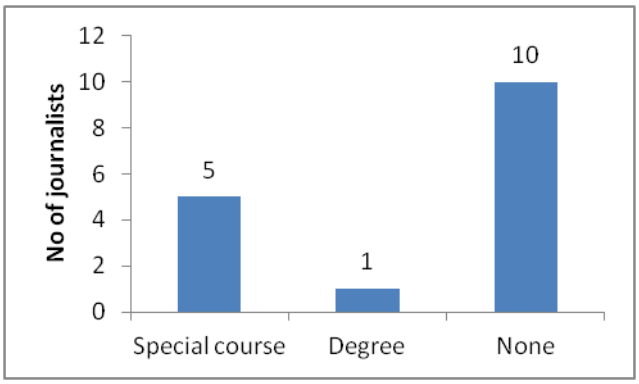

Figure 4. Science and environmental education and training. Most journalists (62.5%) cited having no formal training or education in the scientific and environmental fields. Special courses included diplomas, short courses, educational internships and training programmes in the scientific and environmental fields.

3.4 Perspectives on South African environmental journalism

Table 1. Journalists' responses to questions relating to coverage.

Question	**Response**	**No. of Journalists**
1) Do you think that 'browning' environmental issues will increase environmental coverage?	Yes	16
	No	0
2) Do you think mainstream news media coverage of environmental issues is sufficient?	Yes	15
	No	1