"What's the difference between climate science and climate journalism?"

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ABSTRACT

This study scrutinized the reporting in the *Sydney Morning Herald*, a major NSW newspaper, in three periods between mid-2008 and early 2012, to examine Jay Rosen's clever question and answer: "What's the difference between climate science and climate journalism? The former is self-correcting, the latter has become self-destructive". The approach taken was to sample articles by science journalists that covered interesting stories that were independent of the subject of climate change, stories that mentioned climate change, and others where climate change was the central focus. This approach was rewarding in that it showed the quality and depth that the journalists displayed in their craft. The second step was to examine those journalists who occupied prime space in the opinion pages, and the subsequent letters to the editor. These opinion pieces not only cluttered the debate about climate change, which is serious enough, but cast the whole discipline of science, and those who work in the area, namely scientists, as being unreliable, even vicious and irrational. This puts science under siege and raises ethical issues for journalists of distorting the truth, getting the facts wrong, and being deliberately misleading and uncaring. It appears that editorial policy has exhibited Orwellian doublethink, i.e. the ability to accept contradictory facts simultaneously, and to discipline the mind to ignore the conflict between them. The results support Rosen's view, but with a caveat. The science journalism in the *Herald*, including the science writing on climate change, was not self-destructive. It was instructive, interesting, and the presentation was engaging. The destructive element came from the opinion writers, either challenging the science outright, or promoting just one scientist, a denier of human-induced climate change. The study was then extended to examine how journalists themselves are responding to the representation of climate change in the media, how scientists are viewing the matter, as well as a range of skilled commentators. Australia's Chief Scientist, Ian Chubb, in an address in 2011, was emphatic when he stated that all science risks damage when some science is attacked. Chubb said that climate change is the leading example because it is the very core of science that is being attacked, its principles, its processes, its standards, its ethics and its people. In contrast to such glum conclusions, I delighted in the intellectual rigour and excitement of a challenge that has been accepted by journalists themselves, by scientists, and by members of the community.

Key words: global warming debate; *Sydney Morning Herald;* science under siege; climate change deniers; science and the media; science journalists; media ethics; wildlife and climate change.

Introduction

On his 29 August 2010 post, journalism professor Jay Rosen, from New York University, asked "What's the difference between climate science and climate journalism?", and answered his own question: "The former is self-correcting, the latter has become self-destructive". He goes on to explain his view of why climate science reporting is so bad: "You must realize that having to portray an illegitimate debate fries the circuits of the mainstream press".[1]

Rosen has captured the essence of the meaning of science under siege in these pithy statements. It sets up some testable ideas, such as whether climate journalism has become self-destructive, and whether the debate in the mainstream press is illegitimate and has "fried its circuits". This paper examines these propositions with a particular interest in Australia, and uses a major Sydney newspaper, the *Sydney Morning Herald* (*SMH*), as a case study.

The approach taken was to examine in some depth a sample of articles by science journalists that covered stories that were independent of the subject of climate change, stories that mentioned climate change, and others where climate change was the central focus. The approach also examined the language, how the subject was explained by the journalist, and important supporting details, such as the institution to which the scientist belonged, whether scientists were named, and whether the process of how the scientists arrived at their conclusions was touched on. This approach was rewarding in that it showed the quality and depth that the seven journalists displayed in their craft.

My concentration is on those areas of interest to zoologists and all those who are keen to conserve the native fauna and the ecosystems on which they depend. Lunney and Moon (2008) examined 287 newspaper articles from the *SMH* and the *Sun-Herald* over a year for the portrayal of human-wildlife interactions in the print media. They found that the journalism was, by and large, informative, readable and entertaining. They also concluded that in its presentation of wildlife, the media

1 http://thinkprogress.org/romm/2010/09/20/206752/jay-rosen-on-climate-science-reporting-journalism/?mobile=nc, last accessed 16.1.12

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plays a powerful role that can either further wildlife conservation or leave it as a neglected element of our heritage. Lunney and Moon (2012) looked at a range of print and internet media sources to examine the way the media treat wildlife in their reporting of disasters, and found a growing media interest in wildlife problems, at least partly generated by growing awareness of the risks to wildlife posed by global warming, a hot media topic. The focus of the current paper is on climate change.

Climate change became the subject of a Royal Zoological Society of NSW (RZS) forum in 2010 because of the impact that it is having on our native fauna and on ecosystems as diverse as the Great Barrier Reef, alpine habitats and the arid landscapes (Lunney and Hutchings 2012a). In the lead up to that forum, the subject of climate change and the media continued to have the same uneven treatment that was evident in the lead up to the 2008 RZS forum, *Science under siege: zoology under threat*. This pointed to a sustained distortion of this critical subject. Further, as we were making the final edits to *Science under siege*, it was again evident at the end of 2011, and the first few days of 2012, that this curious and disturbing treatment of climate change in the media was continuing. While the issue occupies space in all media, including talkback radio, for consistency over the three year period, the examination of the media here remains focussed on the *Sydney Morning Herald*. It is not that the *SMH* is an extreme example at all, but it is certainly an important one because of its wide readership (http://www.roymorganonlinestore.com/News/Websites-deliver-additional-readership-for-newspap.aspx).

For those who work as zoologists endeavouring to conserve our native fauna, the subject of climate change is of rapidly growing importance. While from some points of view it represents a new threat that is looming rapidly, with demonstrable effects already evident, it is the compounding effect of climate change on existing threats, such as drought, fire, flood, invasive species, logging, land clearing, overgrazing and overuse of the marine environment that makes climate change such an important subject for conservation biologists.

Therefore, the way that the media handles climate change matters because it may frighten policymakers, politicians, and funding bodies and cause them to steer clear of climate change as an issue to deal with. If that occurs, then climate change is less likely to force policy responses, and its impacts will continue to compound the already difficult struggle to conserve Australia's fauna and the ecosystems on which they depend. It also means that scientists who say they are working on climate change are regarded with scepticism, even disbelief or derision, and when senior figures in science show distress from media attack, the chance of attracting dedicated new scientists to this important discipline is diminished. So, we still have a major battle on our hands because of the importance of the subject.

However, we do know that other strands of science are contested, and thoughtful well-established principles are challenged from ideological positions that frustrate advances in science. This book bears testament to this problem. Prominent among these is the battle over evolution. Other elements of science that are tackled in the media include the subject of research on animals, opportunistic withdrawing of funding from research organisations or individual programs, and the ever-present tension between economic development and environment being seen as a zero-sum game, where you have either one or the other but not both. While this view may be outmoded, its impact has been keenly felt by those involved over long periods in reserving and managing areas such as national parks and nature reserves, trying to save the coastline from being mined, or minimising the impacts of logging in commercial forests. This author has also examined the print media and the Eden woodchip industry; the analysis produced much entertainment in the language, but showed that the media is a major player (Lunney 2005). Everyone who is acutely aware of these struggles in society will know that the media[2] is an important player.

It is not the intention of this paper to cover this range of issues, but to look more closely at the one that is now capturing so much media attention and distortion, namely the subject of climate change. To open this discussion, I now turn to the *Sydney Morning Herald*, its interest in science and scientists, and how sound the reporting of various strands of science has been, including whether the *SMH* has been evenhanded in its treatment of climate change. At issue is whether climate change is a special case as far as editorial policy is concerned, whether climate change science reporting differs from the reporting on other aspects of science, and whether it is the journalists, or the editorial outlook, that are muddying the waters. The first step was to examine a series of articles in the *SMH* in 2008, i.e. prior to the RZS forum on *Science under siege* on 29 November 2008.

Science journalism in the *Sydney Morning Herald* in the latter part of 2008

Generally the outlook promoted by the journalists in the *Sydney Morning Herald* reporting the science of zoology, and its conservation implications, in the latter part of 2008 was that science is intriguing, and scientists are intelligent contributors to society. This paper examines some examples in detail. In the six months prior to the RZS forum on *Science under siege*, there were some thoughtful newspaper articles in the *SMH*, and the frequent use of humour gave the reader a sense of science as an intelligent subject and one that we can play with as the story of discovery unfolds.

Consider the following eleven pieces from seven *SMH* journalists with a special interest in science and the environment.

2. The Macquarie Dictionary (3rd edn) defines media as a plural of medium, or mass media, however it states, in relation to its usage, that while the word media comes from a Latin plural, English media can be singular (the media encourages violence) or particularly if viewed as a variety of different media, plural (the media all have their own special strengths).

In the Science section of the *SMH* on 29 May 2008, journalist Richard Macey, under the clever title "Catch of the day: a sex first for fish", opened his article with the statement that it is the oldest pregnancy ever diagnosed. Australian researchers had found an embryo in a fish that lived 375 million years ago. That find, said Macey, rolls back the date of the first known live birth by up to 200 million years and suggests that sex was happening far earlier than previously believed. Macey records that John Long, Museum Victoria palaeontologist, said that "This was truly a Eureka moment". The article says that the fossil was found in 2005 when Dr Long lead a team to Gogo, a key fossil deposit in Western Australia's Kimberley region. The article reports that another team member, Gavin Young, from the Australian National University said that it had been known from fossils that male fish from 375 million years ago possessed the organs for sex. However, it had been assumed that while eggs were fertilised inside the mother, they only hatched in the water. Macey reported that Dr Young and Dr Long agreed that if the fish were already advanced enough to give live birth 375 million years ago, sex probably evolved earlier still[3]. The article then added that when Dr Tim Senden, from the Australian National University, put the fossil in a CT scanner, the researchers saw an umbilical cord and a yolk sac. The embryo, Dr Young said, was beautifully preserved, and looked like a miniature adult. The article added that Dr Long confessed he had studied the second fossil 22 years ago and had even published a paper on it, wrongly describing what he saw. He said that what he had labelled as bony scales were three embryos, they were tiny little bones. The last line of the article was that the team's embryo findings have been published in *Nature*.

This article by Richard Macey produced an interesting story that properly reflects one of the ways that science moves forward. There are Eureka moments, there are misinterpretations, the discipline takes time, teamwork, multiple institutions, fieldwork, and a high level of specialisation, but the process is self-correcting, with the confession by Dr Long as to his own inability to see the tiny detail that was in front of him. That he persisted in his research allowed him to see the significance of his work, even though there was a 22 year gap between the first misinterpretation and the Eureka moment. The article also points to the contribution from Australian researchers to material that is of world interest. This is good reporting and supportive editorial policy, and it was enriching to have in a science section in the *SMH*.

Under a powerful headline, "Putting sea life to the acid test", with the subheading "global warming and chemical change are creating a deadly double threat to our oceans", was a major piece, occupying most of the page, and Marian Wilkinson presented it as a gripping story (*SMH* 7-8 June 2008). She opened by saying that in Hobart a few weeks ago, a young marine biologist placed the shell of a tiny sea snail on a weighing scale and held her breath. Donna Roberts' critical experiment, said Wilkinson, rested on getting the exact weight of this fragile specimen. The shell specimens dated back to 1996 and the earlier ones had weighed in at 20 micrograms, but Roberts had observed that as specimens became more recent, the weight of the shells had fallen. When her last specimen, from 2005, weighed in at just 10 micrograms, Roberts was reported as saying "Wow, what is going on?"

Wilkinson reported that Roberts' as yet unpublished research is just one reason why her collaborator, Dr Will Howard from the Antarctic Climate and Ecosystems Cooperative Research Centre, this week convened an extraordinary meeting of Australia's leading marine scientists in Hobart. These scientists now know, said Wilkinson, that burning fossil fuels and massive land clearing are not just warming the planet and raising sea temperatures, they are also changing the chemical make-up of the oceans. A vast amount of the carbon dioxide that humans have pumped into the atmosphere since the industrial revolution has been absorbed by the oceans. The chemistry is basic, reported Wilkinson, the ocean is a weakly alkaline solution. When carbon dioxide, sucked in from the atmosphere, dissolves in seawater, it forms a weak acid, making the oceans more acidic. For sea life with fragile shells, corals and countless other sea creatures, a more acidic ocean could be disastrous and have unknown impacts right up the marine food chain.

Wilkinson then reported that Howard told the *Herald* that, "If I could sit Kevin Rudd [then Prime Minister] down tomorrow, I would say: this is an inevitable and inexorable consequence of our putting carbon dioxide into the atmosphere. It's not going to stop. What we need to do quickly is to get some research together where you can anticipate the ecological impacts of this." Wilkinson reported that five years ago, almost no prominent scientist in Australia was talking about ocean acidification, including those who worked on the peak United Nations scientific body, the Intergovernmental Panel on Climate Change. Indeed, reported Wilkinson, the panel devoted just one line to the topic in its Nobel Prize-winning report. That is now rapidly changing. The article concluded with a view that the biggest cause of concern, according to Howard, is that it is starting to look as if some of the changes are happening much faster than anyone anticipated.

The strengths of Wilkinson's piece are that it is well written, dramatic, included the work of a junior female scientist, shows the excitement of discovery and the sharp focus that is necessary to reach the conclusions, and that the research goes through to publication as a part of the process of science. It also shows that scientists can collaborate to produce an overall statement, and continue to work beyond any set statement, such as that of the IPCC, which itself was a report on the current state of play. Wilkinson's writing demonstrates vividly that continuing scientific research is essential if we are to grasp what is happening, and importantly, we need articles such as this to show how scientific advances happen and how conclusions are drawn from the research. It also

3. Sex probably evolved very early (e.g. Pre-Cambrian) if it is taken to mean exchange of genetic material. The fossil fish example may not mean sex *per se*, but rather internal fertilization and development. (Comment from anonymous referee.)

shows that the scientists would like to communicate directly with the Prime Minister in pushing the point strongly, and Marian Wilkinson had provided just that opportunity. Not only did the researcher, Will Howard, get to communicate with the Prime Minister, who doubtless read the paper or was advised of its content, it also communicated with the best part of a million readers. We are indebted to such writing as that shown by Marian Wilkinson.

Shortly after Wilkinson's piece, the massive front-page headline in the *SMH* of 5-6 July 2008 was "The Garnaut ultimatum. Adapt or perish." Journalists Phillip Coorey and Stephanie Peatling reported, in their opening sentence, that "Australians must pay more for petrol, food and energy or ultimately face a rising death toll, economic loss and eventual destruction of the Great Barrier Reef, the snowfields, Kakadu and the nation's food bowl, the Murray-Darling basin". Their second paragraph was equally blunt: "That is the stark ultimatum presented yesterday by Ross Garnaut [2008] in the first comprehensive assessment of the impact on the country of climate change".

In a separate piece, also on the front page, Stephanie Peatling, under the heading, "The Apocalypse, 2100, a climatic odyssey", reported Ross Garnaut's warning of the climatic apocalypse facing Australia by 2100: hundreds of plant and animal species extinguished, an inland migration to escape rising sea levels and severe storms, and the end of agriculture in most of the Murray-Darling basin.

There is no doubt that the Garnaut ultimatum was an apocalyptic vision as presented on the front page of the *SMH*. Here was the economic policy implication of the science of climate change, or at least a dramatic version of it. What a critical reader might do is look at how the science was reported in the *SMH* to see if the policy implications were beginning to become evident in the presentation of the science of climate change. In the *SMH* of 15 August 2008, Richard Macey reported under the headline "It's not you it's the sea: heat hurts shellfish relationships", that "oysters, lobsters, mussels, sea urchins and abalone could be wiped off the menu by global warming, an Australian scientist warned yesterday". In the next sentence, Macey reported that Jane Williamson, a Macquarie University marine ecologist, made the prediction after discovering that climate change is likely to take a dramatic toll on the ability of sperm from many marine creatures to swim to and fertilise eggs shed in the water.

In the *Sydney Morning Herald* on 14 October 2008, journalist Andrew Darby reported, under the headline "Antarctic food chain threatened", that a study has shown that the predicted rise of atmospheric carbon dioxide will wreak havoc on krill, the tiny crustaceans at the heart of the Antarctic food web. Captive bred krill at the Australian Antarctic Division developed deformities as larvae lost energy when exposed to the greenhouse gas levels predicted for 2100. The damage meant that the krill were unlikely ever to breed, said Darby reporting the views of University of Tasmania researcher, Lilli Hale. It is certainly strong writing, in line with the vision in the *Herald*'s reporting of the Garnaut ultimatum, but the pattern of naming the scientist, the institution where the work was conducted and the means by which the researcher arrived at the conclusion, was consistent with previous reliable science writing.

Journalist Richard Macey wrote another engaging piece in the *Sydney Morning Herald* on 14 November 2008. It featured an excellent photograph, with the witty caption, "Taxing task ... Walter Boles takes charge of a cassowary as the Australian Museum shifts precious birds into its new wing yesterday". The article recounts that rows of long-dead creatures waited in queues at the Australian Museum yesterday as staff shifted precious birds and mammals into their new million-dollar collections wing. There were pelicans in plastic bags and birds perched in boxes. Trolleys laden with platypuses and echidnas rattled along the corridors, looking like baked novelty cakes fresh out of the oven, said Richard Macey. More than 10 million of the museum's 16.5 million natural history specimens, including insects, fish, shell creatures and spiders, are being shifted from cluttered accommodation in the old wing to the new extension, which will also house scores of researchers. Macey added an extra dimension by saying that among the historic exhibits being relocated are two Eastern Quolls collected in Queensland by the naturalist John Gilbert, a member of the expedition of the explorer Ludwig Leichhardt. In June 1945, Gilbert was speared to death by a party of Aborigines. "Fortunately", Macey recounts the mammal collection manager Sandy Ingleby said, "the specimens made it back with Leichhardt".

This account is a neat example of good science communication on the part of the journalist, museum staff and the *Sydney Morning Herald*. The story implicitly supports the concept of a museum, natural history collections, and research. It points out that museums can become crowded as time goes on, and expansion is part of the normal process of managing the infrastructure of science, the museum representing a critical place that many people can use for education, for research, and a place for future scholars and other enquiring minds (Hutchings 2010). There was no mention of climate change, but that issue was not part of this story.

The headline "Rat race is over – now it's gone to the birds" (*SMH* 15-16/11/2008) accompanies a splendid photo of two colleagues, Nick Carlile and Mike Jarman, sitting on Brush Island Nature Reserve off the NSW south coast, holding a little penguin and some eggs. The well-written piece by the experienced environmental writer, James Woodford, describes what he called a "massively successful program to eradicate feral rats in 2005 has resulted in a surge of wildlife, making Brush Island the richest for seabirds in coastal NSW". The closing paragraph stated that Carlile said that if the sea level rises as predicted because of climate change, seabirds will need all the safe coastal habitat possible, and that Brush Island is a nice high island, so it is a critical location. This article identified another key feature of the infrastructure for conserving fauna, namely a safe

natural area, in this case, a Nature Reserve. It identified that removing rats by poison in bait stations was crucial for the survival of the birds. It is also a straightforward mention of climate change, and the need to plan in expectation of its foreshadowed impacts, and that in any case, rat eradication programs and Nature Reserves are vital elements in a long-term conservation strategy for Australian fauna, in this example, seabirds.

As well as the headline "A fishy tale: whale shark tracked to inland village", in a piece by science editor Deborah Smith (*SMH* 15-16/11/2008), one of the things that catches your eye straight away is the excellent photograph of a large marine animal – the whale shark. There is a nice human angle too. Smith started her piece by saying that Mark Meekan knew something was amiss when the massive whale shark he was tracking suddenly appeared inland. The Australian marine scientist had been following the meanderings of the five-metre long fish for months, via satellite, as it swam more than 4000 km from Christmas Island up to West Papua and south again. Smith said that Dr Meekan, of the Australian Institute of Marine Science in Darwin, recalled this week how he realised with dismay that the tag, and perhaps the whale shark, had ended up on a remote beach. Then, to his surprise, the tag began to move inland. Conrad Speed, a researcher at Charles Darwin University, went to the far-flung village about 3 km inland, pinpointed the house and offered a reward for the return of the $4000 tag. A local villager, looking for turtle eggs, had found it on the beach.

This first-rate piece of science reporting acknowledges the scientists, and their institutional support, mentions the cost of just one tag, describes with surprise how they tracked the tag inland, and the process of science, in this case marine zoology, as being both interesting and necessary if we are ever going to conserve creatures as enigmatic and little known as the whale shark. Such articles encourage scientists to contact the media, tell a story, and look forward to their research being presented to a million readers. Again, a good science story, but here too climate change was not the subject of the research.

Under the witty title "Scientists shell-shocked after discovery of ancient turtle", science editor Deborah Smith (*SMH* 27/11/2008), opened with the engaging line "How did the turtle get its shell?" She continued the account as follows: "The answer is no longer a *Just so* story. Scientists have unearthed the first fossil found of a turtle at an intermediate stage of evolution, with only half a shell. The ancient creature's belly is fully covered but its back is not. Olivier Rieppel, of the Field Museum in Chicago, said the 220 million-year-old remains –the oldest turtle bones discovered so far –helped solve one the great mysteries of reptile evolution – the origin of the turtle's protective armour." The article went on to say that the turtles hit on a winning body plan early on, and that they have looked much as they do today since the time of dinosaurs. And, said Deborah Smith, scientists have been debating, since the 1800s, the origin of the hard, bony shells, which had provided them with shelter and protection. The article concluded in mentioning an Australian expert in ancient reptiles, Benjamin Kear, of La Trobe University in Victoria, who said that the lower shell might also have acted like a diving belt.

There are some notable features of this article which point to a broad acceptance of science and scientists. The scientists' names are given, along with their institutions. Words, such as dinosaurs, are employed to give the story a timeframe, and the concept of evolution is implicitly accepted as part of the account. The idea that scientists debate amongst themselves is regarded as thoughtful and productive for the discipline. The journalist employed a *Just So* story format, made famous by Rudyard Kipling. The title to the article was most likely framed elsewhere in the editorial process, it is a good pun, and the humour itself automatically disposes the reader to accept the material as being an unbiased representation of what the scientists are saying. This is engaging journalism and encouraging editorial policy, and it would foreshadow that all scientists, whether engaged in the climate change issue or not, would gain a fair hearing. As chance would have it, the present author was interviewed on climate change.

"Climate threatens the koala" was the headline for Marian Wilkinson's piece in the *SMH* of 22-23 November 2008. The opening three sentences read: "Koalas, already listed as vulnerable, are likely to die in greater numbers as they adapt to climate change, which will bring more intense bushfires, rising temperatures, increased drought and a drop in the nutrition levels of their food, a senior NSW government scientist warns. Dan Lunney told a conference of the NSW Nature Conservation Council that rising greenhouse gas concentrations in the atmosphere would push up toxins and lower nutrients in eucalyptus leaves. As leaf quality dropped and bushfires intensified, koalas would be forced to roam further afield as they foraged for food in shrinking bushland surrounded by farms, housing developments and logging operations." The remainder of the article covered some of the details of the koala research, mentioned the relevant policies, and quoted professor Ian Hume as saying "We won't see dead koalas everywhere but over a period of time we'll see fewer and fewer koalas". In the final sentence Wilkinson quoted me as saying "We've got to adapt to a situation where everything we thought was crook is going to get worse". The bold heading on Wilkinson's piece, the quotes, and the details are a fair reflection of my presentation. However, my research had only just started. An increase in extremes of weather is among the predictions of the impact of climate change. A year later, in November and December 2009, intense heatwaves during a drought killed, we estimated, about a quarter of the koala population in Gunnedah in north-western NSW. The details of those heatwaves, combined with the potential impact of a background change in leaf nutrients from climate change, have now been published (Lunney 2012). The final sentence is very much in the vernacular, but its meaning is clear – climate change will exacerbate existing threats faced by the koala, which is a vulnerable species under NSW legislation.

Opinion writers now become the focus

One hopes, in fact relies on, that the reporting in the *SMH* avoids the ethical traps identified by Tanner *et al.* (2005) of distorting the truth, getting facts wrong, deliberately misrepresenting a person and being uncaring.

In the month prior to the 2008 RZS NSW forum on *Science under siege*, I extracted a set of opinion articles and responses on the climate change debate from the *Herald* to examine them in the light of the views of Tanner *et al.* (2005) on contemporary reporting. The debate was a stark contrast to the quality of the science-based reporting in the same paper. The eye-opening debate began with an article by Michael Duffy ("Truly inconvenient truths about climate change being ignored", *SMH* 8-9/11/2008).

Duffy challenged the head of the International Panel on Climate Change (IPCC), Rajendra Pachauri, claiming that he couldn't read his own graphs, the world is actually cooling. He then went on to talk about how bad science publication procedures are. He caused a storm by saying "Editors are more likely to publish research that will make a splash". Duffy apparently believes that the whole science editing process is corrupt. That provoked a spate of letters in response, but first I examined the Duffy article in some detail because the claims of this major opinion piece were so outlandish. Could they stand close examination?

Duffy's opening statement said: "Last month I witnessed something shocking. Rajendra Pachauri, chairman of the Intergovernmental Panel on Climate Change, was giving a talk at the University of New South Wales. The talk was accompanied by a slide presentation, and the most important graph showed average global temperatures. In the past decade it represented temperatures climbing sharply. As this was shown on the screen, Pachauri told his large audience: 'We're at the stage where warming is taking place at a much faster rate [than before]'."'Now," said Duffy, "this is completely wrong. For most of the past seven years, those temperatures have actually been on a plateau. For the past year, there's been a sharp cooling. These are facts, not opinion: the major sources of these figures, such as the Hadley Centre in Britain, agree on what has happened, and you can check for yourself by going to their websites."

Later in the article, Duffy says "still, there's no doubt the majority of climate scientists agree with the view of the IPCC". "Today," says Duffy, "I want to look at why this might be so: after all, such a state of affairs presents a challenge to sceptics such as me. If we're right, then an awful lot of scientists are wrong. How could this be?" This question was addressed, said Duffy, in September in a paper by Professor Richard Lindzen, of the program in Atmospheres, Oceans and Climate at the Massachusetts Institute of Technology. "Lindzen", Duffy said, "probably the most qualified prominent global warming sceptic, suggested that a number of changes in the way science is conducted have contributed to the rise of climate alarmism among American scientists. Central to this is the importance of government funding to science. Much of that funding since World War II has occurred because scientists build up public fears (examples include the USSR's superiority in weapons or space travel, or health problems, or environmental degradation) and offer themselves as the solution to those fears." Duffy continued "Lindzen says that this state of affairs favours science involving fear, and also science that involves expensive activities such as computer modelling". Duffy says that "Lindzen notes we have seen 'the de-emphasis of theory because of its difficulty and small scale, the encouragement of simulation instead (with its call for large capital investment in computation), and the encouragement of large programs unconstrained by specific goals'." "Further", Duffy reports, "Lindzen believes another problem with climate science is that in America and Europe it is heavily colonised by environmental activists." "In addition", Duffy says, "Lindzen claims that scientific journals play an important role in promoting global warming alarmism".

Duffy also mentions the work of John Ioannidis of Tufts University's School of Medicine in Boston. Ioannidis and colleagues suggest that these days journal editors are more likely to publish research that will make a splash than that which will not. "It's possible", comments Duffy, that "the forces described by Lindzen and Ioannidis have imbued climate science with a preference for results that involve (or seem to involve) disastrous change rather than stability".

Either the subject induced a rash of silly letters, the letters' editor simply selected those that were strongly worded because it advanced the dust-up on an important subject or, most likely, there was little experience of the process of scientific discovery and reporting, so little editorial judgment could be exercised on this point. It is a fallacy to be even-handed in the presentation of material if the weight of opinion and views is otherwise, yet the climate change deniers were given about equal space in this round. The letters to the editor on the process of science make the process appear odd, the players half mad and, in the long run, it makes the science, as well as the scientists involved, look unreliable. The real challenge here though is for editorial policy, and its apparently inconsistent handling of the science of climate change. It is instructive now to examine the exchanges that followed Duffy's piece.

It began with a straightforward letter, "Debate heats up" (Brian Charlton, Engadine, SMH 11/11/2008), saying that he went to the Hadley Centre website referred to by Michael Duffy. Charlton reports that it says: "The rising global surface temperature has averaged more than normal 0.15° per decade since the mid-1970s. Warming has been unprecedented in at least the last 50 years, and the 17 warmest years have all occurred in the last 20 years." Charlton goes on to say that "Reference to the accompanying graph does not suggest Rajendra Pachauri's statement is 'completely wrong', nor that temperatures are on a plateau. Many other facts on the site indicate that climate change is real and caused by human activity."

Also on 11 November 2008 there was another letter, under the major heading, "Climate change doubts based on short-term irrelevancies" (Gavin Schmidt,

climate scientist, Goddard Institute for Space Studies, New York), saying "The opinion piece by Michael Duffy contains multiple errors of fact and plenty of errors of interpretation". Schmidt stated that the "realclimate.org site was not founded by an environmental organisation but by nine scientists, including me, who were fed up with disinformation about climate science". Gavin Schmidt concluded, "Should the judgments about science be based on assessments of decades of work that has survived through multiple levels of scientific review, or short-term fluctuations of a single columnist's opinions? It can't be both."

The next day's *Sydney Morning Herald* contained three letters under the heading "Climate change models appear full of hot air". The letters were from Ray Evans, secretary, Lavoisier Group, Newport (Vic), John Nicol, Chairman, Scientific Advisory Panel, Australian Climate Science Coalition, Sinnamon Park, (Qld), and Clinton Rakich, Surry Hills.

The letter from the Lavoisier group is extraordinary. Its opening statement was "Gavin Schmidt's defence of Rajenda Pachauri is characteristic of the bluster and obfuscation from apologists for the Intergovernmental Panel on Climate Change". The next sentences stated "The panel and its client modellers and scientists have a problem: since 1998 average global temperatures have not risen, and since 2002 they have fallen by about 0.7°." Evans then stated: "Atmospheric concentrations of carbon dioxide have continued to rise. All the panel's climate models are based on the paradigm that rising carbon dioxide levels will lead to increasing global temperatures. That this has not happened for a decade shows why their models, laboriously constructed at great cost to the taxpayer, are worthless."

John Nicol's letter stated "The response by Gavin Schmidt to Michael Duffy's opinion piece demonstrates the growing desperation on the part of the proponents of the global warming hypothesis over measurements from satellites and ground stations that differ sharply from models". Nicol added, "Why not acknowledge that the data clearly indicate a global cooling trend not predicted by any of the models over the past eight years and suggest how the models could be improved?"

In contrast, Clinton Rakich's letter made the point that, "Climate change sceptics disregard long-term trends that do not support their arguments". Rakich made a memorable remark that climate change sceptics "cling to the recent lower average global temperatures like a Tuvalu islander clinging to his roof in the face of rising sea levels".

Still rolling on, under the heading: "How little things change when it comes to climate" (*SMH* 13/11/2008), Ken Finlayson wrote "It is no surprise that two climate change deniers pounce on Gavin Schmidt while ignoring Brian Charlton, because Mr Charlton's letter refutes the idea the data are against global warming. Climate change", says Finlayson, "is about long-term trends, not the temperature of any single year – yet Ray Evans thinks the abnormally warm year 1998 is a knockout blow to climate change".

Brian Milton, Emeritus Professor, School of Mechanical and Manufacturing Engineering, UNSW, added a nice touch of irony (*SMH* 13/11/2008):"Watching professor Ian Plimer interviewed about climate change on *Lateline Business* on Tuesday, it was instructive to learn that scientists, academics and researchers who receive funding by peer-reviewed, independent grants and publish in reputable journals are charlatans who act only in their own interest, while those who are supported by, say, the mining and oil industries, are pure and altruistic."

Under the headline, "Being published does not turn fiction into fact" (SMH 14/11/2008), Marc Hendrickx said "The peer-review system of publication in science journals is inherently flawed and is in desperate need of overhaul. Emeritus Professor Brian Milton's comments in support of the system reveal a naivety that appears common among senior academics raised at a time when academic performance, pay and position were not so closely tied to publishing papers. The pressure to churn out papers has put exceptional demand on the peer-review system and resulted in many low-quality papers slipping through – often by watering down or exaggerating conclusions to pander to the whims of editors or high profile reviewers." Hendrickx concluded his letter, which was the top letter in the paper and published just before the forum, by stating, "The best tests of science remain the long-term reproducibility of results and strength of theories against falsification. The current theory of dangerous climate change driven by anthropogenic carbon dioxide emissions has not yet passed those tests. Getting published these days is no guarantee of quality".

Under the collective heading "Debate won't cool over the value of scientific papers on climate change" (*SMH* 15-16/11/2008), there were letters from Associate Professor John Prescott, School of Psychology, University of Newcastle; Jon Jenkins, Bogangar; Colin Jeffrey, Rozelle, and Glen Coulton, Marmong Point. Prescott's letter said "Marc Hendrickx's letter is an excellent example of the sort of unsubstantiated writing that would not be published in a peer-reviewed journal. Where is the evidence that 'low quality papers' are slipping through the system or that reviewers' opinions are 'often disregarded by editors'? As a journal editor, evaluations by my expert reviewers carry the most weight in influencing my judgment about publication. As a contributor to peer-reviewed journals, I wish that publication was as easy as Mr Hendrickx suggests." "Hendrickx repeats the claim cited by Michael Duffy that most findings are proved false within five years of publication. Far from being a failure of the scientific peer-review processes, this reflects (if true) how, over time, these processes facilitate the emergence of reliable scientific data and the theories that explain them."

In contrast to Prescott, Jenkins asserted that "The system of peer review in science has become corrupted, with rorts such as rampant cross-authoring (putting names of non-contributing colleagues on papers to build their CVs) and 'coffee time' agreements to approve each other's works". Jenkins finished his letter with the statement, "In other words, most peer-reviewed published science is useless rubbish".

Jeffrey, in his letter, stated that "scientific knowledge has nothing to do with consensus". "The origin of so-called 'scientific consensus' on climate change is a survey of the abstracts of 928 science articles published between 1993 and 2003, which showed that none disagreed explicitly with the notion of anthropogenic climate warming." "The claim of consensus in scientific opinion is simply a way to avoid debate by asserting that the matter is settled." Jeffery concluded with the view that: "The true test of science, making it more robust by attempting to disapprove it with experiments, rather than attempting to prove it with computer simulations, has fallen by the wayside through socio-political pressure."

Coulton made the simple observation that, "Mark Hendrickx suggests we should remain sceptical of scientific theories until their opponents demonstrate that cause-effect relationships hold up under repeated testing. The trouble with this approach to the global warming theory is that if the first demonstration is affirmative, there will be no world left to reproduce on."

The debate continued, and Bob Beale (SMH 6-7/12/2008) under the heading "Climate debating points subtracted in short term", opened with a strong statement that, "Accusing a scientist of falsifying data is a grave and professionally damaging charge, about the worst one can make. Michael Duffy was careless and wrong to allege that Rajenda Pachauri, the chairman of the Intergovernmental Panel on Climate Change, 'fudged' climate data during his recent public lecture in Sydney." Beale stated that, "I have checked the graph in detail and watched the lecture on YouTube. It's clear that Dr Pachauri was truthful and Duffy made a naive error: he did not, or could not, see from the body of the hall that the graph showed his 'plateau' because he was looking at a longer-term trend line – a running average of yearly figures. That line includes figures for the past decade, and does rise sharply." Beale concluded his letter by saying, "Whatever the short-term picture, it is no comfort at all that 11 of the past 12 years were the warmest on record. Mr Duffy neglected to mention that truth."

Climate change was the biggest topic on the environmental media front from the lead-up to the 2007 Federal election, through 2008 when the new Federal government signed the Kyoto protocol. The economic crisis of late 2008 threw what has so often been portrayed publicly as opposites – environment and economics – into apparent conflict again. Here the role of journalists playing the role of climate change sceptics took on a more central place in our debate on the future of the planet.

Michael Duffy not only challenged the head of the IPCC as misunderstanding the science of climate change, he provoked a rare series of letters to the editor on the process of science, especially peer review and the role of scientific journals. It was an instructive exchange in that it gave a glimpse of a world that lies behind the statements made by scientists, but it gave little guidance as to how science works or progresses.

That gap in understanding gave scope for this contrary piece just two days before the RZS forum. Under the heading "Beware the church of climate alarm"(27/11/08), Miranda Devine wrote that "... the real fear driving climate alarmists wild is that a more rational approach to the fundamentalist religion of global warming may be in the ascendancy – whether in the parliamentary offices of the world's largest trading bloc or the living rooms of Blacktown". Devine drew on Ian Plimer's view that "Climates have always changed, and they always will". Devine stated that "Plimer said one of the charts, which plots atmospheric carbon dioxide and temperature over 500 million years, with seemingly little correlation, demonstrates one of the 'lessons from history' to which geologists are privy: 'there is no relationship between carbon dioxide and temperature'." Devine said that "Plimer says that creationists and climate alarmists are quite similar in that 'we are dealing with dogma and people who, when challenged, become quite vicious and irrational'. "Devine also expressed her view that "It is difficult for non-scientists to engage in a debate over what causes climate change and whether or not it can be stopped by new taxes and slower growth, because dissenting voices are shouted down by true believers in the scientific community who claim they alone have the authority to speak".

From that point of view of science reporting, Duffy, and the flurry of letters that followed, and Devine, provided a sharp contrast with the material from the science reporters who also work for the *Sydney Morning Herald*. It would seem that there are two categories of journalists, the first being science reporters, the second being opinion writers. In this case, the opinion writers have taken a particularly hostile stand to the science of climate change and the scientists who work on it. Duffy's writing was, in my opinion, poor science writing. He criticised others, put his own piece of evidence forward, then made the claim that he was right. Even if Duffy were to claim a right to free speech, his grasp of the process of science as displayed in that article was ill-informed. Hence the dreadful debate that followed. Letters to the editor took Duffy to task on the poor quality of his reporting of the presentation by Rajenda Pachauri, the chair of the IPCC. Other letters seized the opportunity to attack the science of climate change. The debate then degenerated into how science is reviewed and published, and the debate would have left the distinct impression in non-scientists that the system has serious flaws, and thus what is published is suspect.

It is hard to believe that the non-scientific reader would have been other than confused by the debate, and either saw it as a backroom dust-up as to what constitutes sound science and how research progresses, or at worst, non-scientists, including many politicians and other decision makers, would have drawn the conclusion that the science of climate change is weak, thus leaving the option open to wait until the debate is resolved before taking action on climate change. It was, in my opinion, a poor representation of science and how researchers move forward on the front line of new ideas, testing them, revising and more testing.

A distressing aspect in the article by Duffy was the opportunity it gave to climate change deniers, i.e. those who deny that the climate is changing due to human-generated atmospheric CO_2, to present themselves and their views in a way that gave them some credibility because Duffy had led with such a strong opinion piece.

Devine had a different approach in that she championed one person, Ian Plimer, and used his words and phrases as the centre of her piece. In this debate, his views are well removed from the views of other scientists and the growing clarity on this subject (Lunney and Hutchings 2012a,b). Devine also put the view that dissenting voices are shouted down. From this sample in the *SMH*, it would appear to be the opposite. Duffy and Devine occupied prime space in the opinion pages, and they not only cluttered the debate about climate change, but cast the whole discipline of science, and those who work in the area, namely scientists, as being unreliable, even vicious and irrational. This puts science under siege.

Arguably a greater challenge here is to try to fathom editorial policy. Science reporting requires a genuine interest in science, a willingness to understand the particular science being reported, and the ability to report fairly what the scientists are saying. The *SMH* science reporters, from the sample selected and discussed in this paper, are up to the task. Yet, it seems that when the opinion writers hold strong views about climate change and its causes, they are allowed, by editorial policy, to promote a jaundiced view of science and scientists, and selectively use material to promote the idea that the issue of human-induced climate change is a furphy, i.e. a rumour or a false story. It appears that editorial policy exhibits doublethink, the term coined by George Orwell in *Nineteen eighty four*, which means, according to the Macquarie Dictionary (revised third edition), the ability to accept contradictory facts simultaneously, and to discipline the mind to ignore the conflict between them. The writing of the seven science journalists reviewed here, and the two opinion writers, and their supporters in the letters section, allow a case for doublethink to be made.

If editors publish, as balanced reporting, story for story, letter for letter, they are actually favouring the climate change deniers, because they are so few compared to the size of the group who do understand both the science and the implications of change. We need to look critically at editorial policy and consider the ethics of the matter. Recognising the amount of media space they have, one could conclude deniers have won the primary vote. This raises the ethical issues identified by Tanner *et al.* (2005) of distorting the truth, getting the facts wrong, deliberately misleading, and being uncaring. The failure is the inability to grasp the science; it is a failure to support skilled investigative reporting. Davies' (2008) view is particularly pertinent here because of its focus on climate change in the context of what he sees as 'Flat Earth News'.

Fortunately, the ABC's 7.30 Report produced a first-rate interview, and sections of that interview with Nick Davies are presented below. The objective of going down that path is to examine what has happened in journalism, such that both the science of climate change, and the scientists involved, are treated in such a shabby fashion. The aim here is not to try to prohibit opinions, far from it, but to make the point that science, and in this case the science of climate change, is not a subject where opinions rule and the discipline of science is dispensable. Science is a major strand of our culture and it cannot be disposed of by writing an opinion piece.

"Media industry in crisis as standards decline"

For the vast majority of Australians, their understanding of findings and advances in science comes via the mass media. When the reporting of science is sensationalised, 'dumbed-down' or otherwise distorted, and much worse, when media companies or journalists pursue a personal or political agenda through their reporting, the general population is denied information and is manipulated. Journalists work to a code of ethics[4] which, with respect to the presentation of climate change in the opinion pages, seems to be tested. There is a broader issue here that is not particular to the *SMH* and appears to be worldwide. An insight into this matter came via a journalist, Nick Davies, and his view about journalism and climate change.

What follows is an edited version of relevant aspects of the transcript of an interview on ABC Television's 7.30 Report of 27 August 2008 by reporter Kerry O'Brien, who spoke with investigative journalist Nick Davies about his new book, *Flat Earth News* (Davies 2008). Davies argued that journalistic standards are declining the world over as cost cutting and government pressures take their toll on the industry. The transcript lays bare one of the difficult issues of the portrayal of science in the media, the matter of standards of reporting.

Kerry O'Brien: "Nick Davies, you say journalism is in a bad state. What are the symptoms?"

Nick Davies: "At its heart what's happened is that big corporations have taken over newspapers which used to be owned by small family firms and they've injected the logic of commercialism into newsrooms and that logic has overwhelmed the logic of journalism."

"If you take away time from reporters, you are taking away their most important working asset. So they can't do their jobs properly any more. So in this commercialised world, you have journalists who, instead of being active gatherers of news – going out and finding stories and making contacts and doing funny old-fashioned things like checking facts, they've become instead passive processors of second-hand information, stuff that comes up on the wire, Reuters or AP, stuff that comes from the PR industry."

O'Brien: "So how does it manifest itself?"

Davies: "Well it's false stories, is the big manifestation. So I started writing this book – the trigger, not the subject of the book, was those notorious weapons of mass destruction."

4. http://www.gwb.com.au/99a/ethics.htmlhttp://www.smh.com.au/ethicscode/index.htmlhttp://www.law.uts.edu.au/comslaw/factsheets/journalism-and-media-ethics.html

O'Brien: "When you talk about the role and influence of the PR industry, you give one example of a scientific report in England on climate change being seriously overcooked in a press release and what then happened. Can you just as briefly as possible elaborate on that story?"

Davies: "Okay so I took one example where some scientists had run computer programs to try to predict the impact of small changes in temperature. And in order to get publicity, they picked the most extreme results that they had come up with, and therefore the press release which they put out actually distorted their own results.

"That press release was then taken and distorted further by the coverage and it's a microcosm of this kind of two-step dance that PR and journalists engage in. Where the PR people distort and then we distort further and the poor old consumer on the end, the person who has bought the newspaper who wants or needs reliable information about the world, is being terribly badly cheated."

O'Brien: "Is that what's happened with the climate change debate?"

Davies: "Climate change is very interesting because what you've had there is a kind of three-way battle involving PR overwhelming journalism.

"So you had a big bunch of corporations led by Exxon who were in the business of denial and who spent a fortune setting up front organisations and academic think-tanks to put out reports to justify their position of denial.

"Then you had a breakaway group of corporations by Shell and BP who are much more subtle. They said okay there's a problem with climate but we are part of the solution. And they also generate PR stories to serve their purposes.

"And then third corner you have the environmental groups, people like Greenpeace, who even though they have the scientific consensus on their side nevertheless engage, as I've shown in the book, in some pretty breathtaking exaggeration in order to manipulate the media to take up their position.

"In the middle of this kind of three-way fight you have the equivalent of civilians in a war zone, that is to say the readers and consumers of news media, who suffer like civilians do because they're being bombarded with misinformation, and how any of us are supposed to know what the truth is about climate change and its implications when actually the news is being subverted by PR from three different directions it's really a very worrying thing when you see the structural likelihood of media being vehicles for PR stories."

We now have a problem that goes far beyond opinion writers and climate change deniers gaining space in the *Sydney Morning Herald* at the expense of sound science. As Nick Davies says, it is the civilians, the consumers of the news, who suffer in this battle. Given this insight, and with increasing recognition of the importance of climate change, we can now turn to the end of 2010 in the lead up to the RZS forum on wildlife and climate change (Lunney and Hutchings 2012a) and briefly examine the climate change debate, again in the *Sydney Morning Herald*.

Climate change in the print media: fast forward two years to 2010

For the annual forum of the Royal Zoological Society of NSW at the end of 2010, the decision was made to run with climate change and wildlife as the theme (Lunney and Hutchings 2012a,b). In the lead up to the forum, it was apposite to re-examine the debate in the print media. For consistency with 2008, the analysis was limited to the *Sydney Morning Herald*. The material was there in 2010, well written and engaging, but distressing if one expected to see sound science emerge as the dominant form of reporting on the science of climate change. The following brief scan of material shows the form of the debate in late 2010. Consider the following five articles in the lead up to 2010 RZS climate change forum.

An article in the *Sydney Morning Herald* on 24 July 2010 ran a headline "Sceptics warmed to scientist's eloquence". It was in fact an obituary statement of Stephen Schneider who died on 19 July 2010. The *Herald* quoted Benjamin Santer, a leading climate researcher at Lawrence Livermore National Laboratory, who described his colleague as the Carl Sagan of climate science: "Steve Schneider helped the world understand that the burning of fossils had altered the chemistry of Earth's atmosphere, and that this change had led to a discernible human influence on our planet's climate". The article concluded with the point that despite threats he had received, Schneider continued to speak out in public and urged fellow scientists to do the same. "In my view, staying out of the fray is not taking the 'high ground', it is just passing the buck," he wrote on his website.

In the *Sydney Morning Herald* of 28 July 2010, under the heading "There is strong support for early and direct action", Samantha Mostyn, sustainability campaigner, made a primary point in a brief article: "Over the past three years the climate change debate has been stranded by politics and the language of fear, blame, cost and complexity. Precious time has been squandered in the politicisation of climate change. It descended into a campaign against climate scientists, replete with assertions that controlling waste and pollution would cripple the future prosperity of the country."

Under the heading "Abbott still doubts planet is getting hotter", Ben Cubby (Environment Editor *SMH* 17/8/2010), reported that, "Tony Abbott [Opposition Leader in Federal Parliament] has restated his sceptical views on climate change, and suggested the world may be getting cooler, as the Australian Academy of Science [2010][5] released a new report warning of the future impact of global warming. The Opposition Leader said he accepted 'that climate change is real', but he did not back away from his view, based in part on the work of the Australian climate sceptic Ian Plimer, that the world is getting colder." Cubby also reported that, "Asked by the ABC's Four Corners if he still disputed that humans are responsible for climate change, Mr Abbott said: 'Sure, but that's not really relevant at the moment. We have

5. http://www.science.org.au/reports/climatechange2010.pdf

agreed to get a 5 per cent emissions reduction target.' He suggested he harboured doubts about the work of the Intergovernmental Panel on Climate Change, the United Nations body charged with collating global warming research."

Cubby also reported that "The renewed argument over the science of climate change comes as a study of 300 federal, state and local government political leaders, by the University of Queensland, suggests sharp differences in beliefs and understanding around global warming between the Coalition and Labor parties". Coalition MPs were less likely to believe climate change is happening, and showed less trust in scientists, although the results reflected only those who decided to take part in the survey. Cubby then reported that Dr Kelly Fielding, of the university's Institute for Social Science, said "This difference is unlikely to have occurred by chance. What it shows is that a much higher proportion of Liberal-National politicians are uncertain in their views, whereas on average the Labor politicians are more likely to agree with the statements made by scientists."

Under the headline "Scientists defend UN climate panel", environment editor Ben Cubby (*SMH* 1/9/2010) stated that the country's leading climate researchers had endorsed the findings of an independent investigation into the Intergovernmental Panel on Climate Change, the United Nations global warming body, which found that its scientific findings were sound but that its structures needed to change and become more transparent. Cubby said that the IPCC was subjected to sustained attack based on claims that its most recent report overstated the rate of melting glaciers in the Himalayas. Cubby added that some scientists and researchers have also criticised it for understating some risks, and being too conservative in predicting the rate of global warming.

Under the headline "Psychology provides insight into why people doubt climate change", Ben Cubby (*SMH* 20/9/2010) opened his piece with the report that many people don't believe in global warming because everyday life may have trained them to doubt it, according to a new University of NSW study that brings together climate science and cognitive psychology.

What followed was an interesting commentary on science communication: "As the physical science underpinning human-induced climate change has grown more and more solid, more people have been growing sceptical of it, according to the paper The Psychology of Global Warming, published in the Bulletin of the American Meteorological Society. 'Simply presenting the facts and figures about global warming has failed to convince large portions of the general public, journalists and policy makers about the scale of the problem and the urgency of required action,' the paper says."

Cubby reported that two Sydney researchers, psychology lecturer Ben Newell and climate scientist Professor Andy Pitman, "identified different classes of perfectly normal psychological phenomena that can tend to turn people into so-called climate 'deniers'. The first concerns 'sampling issues'– the idea that people normally try to refer to real-life examples to draw conclusions and may be heavily influenced by recent media coverage." An interesting point was made that "For example, if you read or hear opinions from climate change sceptics about 50 per cent of the time then this could lead to a bias in the perception of the balance of evidence in your mind – that is, that the science is only about 50 per cent certain," Dr Newell said.

In a line that will amuse, or irritate, the mathematically minded, the article then stated that "People are also heavily influenced by 'framing issues'– dealing with how information is presented to them. The figure 0.2 means the same as 20 out of 100, but the latter proportion makes the information seem much more concrete". Arguably a more telling point is the view that "People construct mental models which they use to judge new information, and these models are usually built only on a few fragments of information, the study said". Cubby reported that the authors drew on dozens of studies into people's reactions to news about climate change, some of which suggest that certain types of people are more likely to find the evidence for human-induced climate change less convincing than others.

What is particularly interesting about Cubby's article is that he is a journalist and would know full well how to present the science and how not to present it. He would also be well aware that there are people in the community who will take much more convincing than others on an issue such as climate change, where the science is relatively new, is contested in the media, and the future it creates is grim but seemingly distant. Possibly the most important point from a media analysis is that people construct mental models built on only a few fragments of information. Cubby could well have added that most of those fragments come from the media itself. Therefore Cubby, his colleagues, and editorial policy are critical elements in the climate change discussions and how we might adapt the way we manage the impact of climate change.

Shooting the messenger

When these five articles are examined collectively they show an interesting development in the debate over climate change. The issue on one hand is that climate science is becoming increasingly better established, but the acceptance of it appears to be no stronger. This in turn has caused introspection as to why people are sceptical or even hostile to the science. Part of the importance of reporting Tony Abbott's position, as Leader of the Opposition, is the way he portrays the science, harbouring doubts about the IPCC and taking a different view to the Australian Academy of Science. It seems that major bodies of senior scientists in their reports have not persuaded the Leader of the Opposition to accept the science as it stands, rather than just relying on one climate change sceptic, Ian Plimer, and to concentrate on dealing with the policy outcomes of the science. To challenge the science itself just by casting doubt on it allows the discerning reader to conclude that science itself is under siege. If Tony Abbott is casting doubt on science as a way of dealing with policy needs, then that is a misuse of science. It is as simple, or as silly, as shooting the messenger.

As a nation, we need to grasp how scientists work, how they communicate, and to be more involved in the process of science because of its implications for how we live, including managing the land and wildlife. However, in the context of this paper, the issue is how the media reports the subject of climate change. It could be argued that Ben Cubby, by giving Tony Abbott so much coverage, enables his message of disbelief to be promulgated and be acceptable, but it could more forcefully be argued that Cubby has made plain what Tony Abbott[6] is thinking on the subject, which is critical in the policy debates, especially in parliament.

The by-product here for science is the direct attack on scientists and their methods, such as robust reports, and the widespread support that these reports enjoy in the scientific community. In effect, Tony Abbott is, perhaps unwittingly, undermining the process of science itself. This toying with the science when the findings are politically hard to manage is putting science under siege. This matter was followed up a year later.

The *Sydney Morning Herald* at the end of 2011 and early 2012

As this book, *Science under siege*, was being prepared to go to press, it was illuminating to again look at the journalism and editorial policy in relation to climate change in the *Sydney Morning Herald*. What was surprising was that it was largely a rerun of the end of 2008, with good reporting contrasting with misleading opinions that were doing a disservice to science. Firstly, I shall start with the positive material.

In the *SMH* Weekend Business section of 3-4 December 2011, regular journalist Paddy Manning, under the headline "Hard to swallow but food security threat is very real", starts the story as follows: "It's intrinsically scary: 7 billion people, growing to 9 billion. Can we feed them all? Already, obviously, we don't. But climate change could make global food insecurity much, much worse. This week, coinciding with the opening of United Nations' climate talks in Durban, we've seen Oxfam warn that extreme weather threatens food security – from the drought in the Horn of Africa to heatwaves in Russia destroying crops, to heavy monsoonal rains pushing up rice prices in south-east Asia." Manning has grasped the central message of the long-term problem we face as climate change compounds the problem of rising population levels to the extent that we shall be unable to feed every person as the world's population grows quickly from 7 to 9 billion.

The lead front-page story on 12 December 2011 in the *SMH* had a bold title: "Nations agree to climate deadline". Environment editor Ben Cubby opened the account by saying the world's heaviest greenhouse gas emitters, including China and the US, had launched a plan to unite all major nations under a legally binding pact to slow climate change. On page 4 of the same edition of the *SMH*, Ben Cubby had another piece under the major heading, "Durban pact at least creates a climate for a binding deal". Cubby creates an interesting atmosphere by saying that red-eyed delegates snatched naps in corridors, charter flights were held back and the press room's photocopier broke down as the UN climate talks in South Africa finally ground to a close yesterday at 5 am local time – 35 hours behind schedule. Cubby touched on the political situation in Australia, by saying that, overall, the outcome appeared favourable for the Federal government, because it could truthfully say to the public that the rest of the world is moving at a similar pace to Australia. The problem is, said Cubby, this pace is far too slow, and utterly out of step with the advice governments at the Durban conference were receiving from scientists. Cubby added that, based on the current levels of emissions cuts promised by the world greenhouse emitters, the world is on a trajectory towards dangerous climate change. The best estimates suggest that about 3.5° C of global warming this century will soon be unavoidable, unless emissions can be reined in sharply over the next few years.

Ben Cubby followed this up in the *Sun Herald* (the Sunday version of the *SMH*) on 1 January 2012 in a section entitled "12 things you need to know about". The first of the 12 items had the heading of "The environment". It was Ben Cubby's piece. The article opened by saying that the carbon price comes into force in July, set at $23 a tonne, before turning into an emissions trading scheme in 2015. He reported that on the international front, world leaders will gather in Brazil in June, 20 years after the original Rio Earth Summit, which was the conference that laid the foundations for banning leaded petrol, controlling pollution and starting the process that led to the Kyoto Protocol on cutting greenhouse gases. In December, Cubby reported, the next UN climate change conference takes place in Qatar, where work will continue on designing a treaty to cut greenhouse gas emissions and reduce the risk of dangerous climate change.

Cubby had reported on an important conference on climate change and done so in an amusing fashion, as well as made the point crystal clear on the science when he said that the pace of action to reduce climate change is far too slow, and utterly out of step with the advice governments at the Durban conference were receiving from scientists. Cubby reported where the tension actually lies, namely between the science of the matter and the international political response.

Again in the *Sun-Herald*, on 1 January 2012, there was an item in the culture section with the headline "Climate debate takes a new angle". The article opened with the statement that climate change was supposed to be "the greatest moral challenge of our time", as the former Prime Minister Kevin Rudd put it, and that Nigel Jamieson's

6. A review of Tony Abbott's 'climate myths' and their contrast with 'what the science' says has been posted on "Skeptical science, getting sceptical about global warming scepticism". The post was by John Cook on 7 June 2011. http://www.skepticalscience.com/Tony-Abbott-denies-climate-change-advocates-carbon-tax-in-the-same-breath.html

As the world tipped was inspired by the 2009 Copenhagen climate change conference. The show features a stage that slowly becomes vertical, leaving performers hanging in the air. Floods, famine and drought will be screened on the vertical stage as actors perform aerial theatrics in the show, which will play at Sydney Festival's first night and at the Parra opening party on January 14. Jamieson said the spectacle of harassed bureaucrats failing to notice that as the world around them slides towards disaster "seemed the perfect metaphor" for the climate change debate.

Ben Cubby's reporting in December 2011 on the Durban conference, his highlighting the environment features for 2012, along with the cultural event *As the world tipped,* has presented the climate change debate in a competent way from a reporting point of view, and an amusing way from a cultural perspective. Then, surprisingly, in the *SMH* on 2 January 2012, Paul Sheehan produced an odd piece under the headline, "More storms on the way unless we learn to manage the land".

Sheehan opened his piece with a catalogue of extreme weather events in the last year, then posed the question as to whether it was either the onset of global warming, the latest cycle of El Nino Southern Oscillation, the combination of global warming and El Nino, or the monumental mishandling of the landscape. Sheehan said that the most interesting explanation for the extreme weather came from a landscape restorer, Peter Andrews, who chose the fourth option. Sheehan quoted Andrews as saying that "Our landscape is still on a dramatic downward spiral". Sheehan stated that Andrews discounts the argument that we are seeing the impact of global warming, saying, "the whole global warming argument misses the point. Yes, we are facing an environmental disaster. Yes, it is urgent. Yes it is caused by our own activities. But we have misdiagnosed the problem ... In terms of dealing with Australia's problems, the global climate warming industry is a giant con."

There was an immediate response in the letters section to the *SMH* on 3 January 2012. Under the general heading, "Landcare is vital – ditto acting on global warming", the lead letter was by Geoff Gordon. It was a pleasure reading a letter from a colleague, whom I have known for decades, and we were also in the same department for a few years. Gordon's letter stated: "Peter Andrews is right. We have mismanaged the land. We have indeed changed the landscape through 'cropping, herding and irrigation', and so changed the weather, as he writes. But Andrews and Paul Sheehan are wrong to set these changes against the well-established global warming that has resulted from our burning of fossil fuels. Bad management of the atmosphere will simply compound the land management problems. To embrace one set of causative factors for land degradation does not mean that other causative factors don't exist. All causes of land degradation, including global warming, have to be tackled in concert. To say that 'the global warming industry is a giant con' is irresponsible talk to anyone who really cares about the future of Australia."

On 4 January 2012, in the *SMH* opinions page under the heading "Age of the amateur with reason in retreat", journalist Erik Jensen noted that the warming of the world has generated an economic panic that celebrates the untrained. Jensen reported that five years ago, more than two thirds of respondents to a Lowy Institute poll thought climate change to be a serious and pressing problem requiring action that could involve significant cost. Last year, that figure had dropped below half. The collapse of consensus reflects no change in science. The academic community has not demurred. Is it a triumph of misinformation over fact? Australians, said Jensen, would sooner be lied to than taxed. Jensen's writing is succinct, witty but ultimately dispiriting if he is right about preferring to be being lied to rather than taxed. His heading is most apposite, it is reason in retreat, which captures the essence of *Science under siege.*

In the *SMH* of 5 January 2012, there was a clutch of letters under the generic heading of "Present the facts – we'll take it from there, thanks". Jonathan Holmes, presenter of media watch on ABC TV, said that ,"Gerard Henderson has been complaining about the ABC's 'leftish drift' for as long I have been in Australia – 30 years come April… However, when the former ABC chairman Maurice Newman complained about 'group think' among ABC journalists, he was not talking about left-wing bias, real or supposed. He was discussing how they report climate change science. Mr Newman thinks his own doubts about the scientific evidence for anthropogenic climate warming should be better reflected in the ABC's coverage of the topic." "I think", said Holmes, "its reporting should reflect the views of the majority of qualified experts." "That", said Holmes, "was the substance of a disagreement which took place in a supposedly private forum at which Mr Henderson was not present. His column misrepresents what both Mr Newman said on that day, and me." What is interesting about the letter from Jonathan Holmes is the potential influence of a head of a major media outlet wanting to impose his views on how journalists should handle the subject of climate change. Holmes' letter is a startling insight.

In the section on *The World* in the *SMH* of 6 January 2012, the Republican race being run by Rick Santorum for the US presidency was covered. Under the heading "Bombs, bans and zero tolerance the mark of this presidential aspirant", and the subheading "God, guns and science", the statement was "Describes the suggestion that humans have contributed to global warming as 'patently absurd'." "Wants intelligent design taught in America's schools as science because there are quite legitimate problems and holes in the theory of evolution". It was a tough day for science that such views gained such a high profile in 2012. To describe as "patently absurd" the suggestion that humans have contributed to global warming is a clear case of science under siege.

In less than a month from 12 December 2011 to 6 January 2012 there was an extraordinary display of responses in the media on the subject of climate change. The next step is to look beyond the detailed reports of various journalists, letter writers, opinion writers and the editorial selection process and what gets printed, to the views of others about the media.

Objectivity and the climate debate

On 2 December 2010, the ABC, in its Big Idea series, published a debate on objectivity and climate change[7]. It was a panel discussion hosted on 22 October 2010 by the University of Technology Sydney (UTS), in conjunction with the Australian Centre for Independent Journalism, to present the George Munster Award for Journalism. As part of the annual event, a panel of Australia's top journalists and journalism academics take a look at their profession and how their work does or does not serve the public interest. The panel comprised climate scientist Ann Henderson-Sellers, ABC's national environment and science correspondent Sarah Clarke, Deputy Head of Journalism at Victoria's Monash University Philip Chubb, *SMH* Environment and Climate Change reporter/editor Ben Cubby, and Associate Professor of Journalism at UTS Tom Morton. The ABC's web site did not have a transcript, but there was a ready link on the web site to the video. It was fascinating to watch the panel discussion in the context of thinking critically about the reporting of climate change. The web site did give some context. It turned to the question of how to maintain journalistic integrity and balance when reporting on climate change, and how to objectively report this issue without risking it being hijacked by unscrupulous, less-than-credible voices.

Some of the text of the audio panel discussion was reproduced in the *Green Left Weekly* of 13 November 2010, in an article by Simon Butler under the heading "Media foster climate of denial"[8]. It is a catchy headline, and it is a concept that draws those who are disaffected by mainstream media. It also provided a ready source for the words, rather than listening and typing. What follows are a few of the points made as reported in the *Green Left Weekly*. Henderson-Sellers said that far too often, scientifically robust views are given equal weight to non-expert opinions that are not based on facts. Chubb said that giving equal coverage to deniers was not balanced reporting, but led to a bias in favour of climate deniers. His figures were interesting: "The fact is that a recent, creditable study has indicated that 97% of published, peer-reviewed climate scientists support the concept of anthropogenic [human-caused] global warming." "If you have a media representation of that reality which accords people who do not have that expertise … equal representation in the media, you are utterly distorting the situation." "You are creating a position [that] is biased, in the sense that it is distorted. And you are confusing the public." Chubb said the mainstream media's willingness to give deniers a platform was bad journalism. In practice, it means the most important debates about the climate crisis are buried. Cubby responded: "One thing about journalism that is different from, say, a scientific journal, is that it is also about story-telling and to some extent about entertainment as well". There was a nice exchange clearly recorded on video where, as *Green Left Weekly* reported, Henderson-Sellers shook her head in disagreement, and Cubby responded: "Ann can shake her head at that, but it is. You've got to sell newspapers. You've got to make people watch their TV show." Clarke said: "I think [the ABC and Fairfax] are the ones who have delivered the objective, scientific [analysis]."

This debate took place just before the RZS forum on climate change. Among the many points that it raised is that climate scientists, science journalists, and conservation biologists who work to adapt management strategies for fauna in the face of a changing climate need to speak up and make their points strongly and clearly. Bad press is making this difficult task even harder, and one way to deal with it is to speak up, or write, or both. This book on *Science under siege* is one contribution, in conjunction with the RZS companion piece on *Wildlife and climate change* (Lunney and Hutchings 2012a). Another point is the difference of opinion between Philip Chubb and Ben Cubby as to whether the reporting should be entertaining and tell a story. When one listens to a panel discussion it is somewhat academic in that it did not pick on a particular example. When you read Ben Cubby's articles you might consider that he has told a good story, he was entertaining and he did get the science, and the scientists' views, fairly reported. In that instance, one might side with Cubby's view.

In contrast, to accept that ABC and Fairfax, as Sarah Clarke maintained, have delivered objective climate change journalism does not stand up, at least in the case of Fairfax, the publisher of the *SMH* which is the focus of this paper. One can agree with Sarah Clarke that Ben Cubby, and a group of fellow science journalists from the *SMH*, do live up to Clarke's claim. But, the opinion writers, in this case Miranda Devine, Michael Duffy and Paul Sheehan, and a raft of letters from climate change deniers, do not, in my opinion, fulfil the claim of objective scientific analysis. To emphasise a point made by Philip Chubb, as I recorded from the video clip, the essence of journalism is verification and truth. The *SMH* has not passed that test, although most of the journalists have met that criterion, notwithstanding the discussion about whether the article can run the story, be entertaining, and avoid being what Ben Cubby called, "worthy but dull". What this means is that media analysis that runs on generalities, such as "media foster a climate of denial", doesn't really come to grips with the problem of the misreporting of climate change science and climate change scientists. It does require an ability to distinguish among the journalists, rather than lump them into one group. Similarly, one needs to see the scientists working on climate change, and the issues that follow from it, such as conserving our wildlife, as having a diversity of scientists and a range of ways of presenting their ideas.

Having made a case to divide the journalists in the *SMH* into two groups, those that fulfilled the criterion of reliable scientific reporting and those that did not pass Chubb's

7. http://www.abc.net.au/tv/bigideas/stories/2010/12/02/3082854.htm last accessed 9.1.12.

8. http://www.greenleft.org.au/node/46075

test of verification and truth, it could be also argued that within each group there are different divisions. One could form an opinion that Devine and Sheehan relied on someone else's views to rail against climate change, but Duffy ran his own case. That makes Duffy unusual, particularly as he was so strident.

Duffy himself provided insight into this matter in an essay in the *SMH* of 28-29 January 2012, under the heading, "In dumb luck we can trust". The subheading was more revealing: "The search for meaning easily leads to delusion – research shows attempts to explain events tend to be proved false". Duffy wrote "...years ago I entered a state of doubt about explanations. I was working as an opinion columnist and slowly it dawned on me that, despite claiming insight into the workings of Australian politics and society, most in my profession were constantly taken by surprise by what happened. Despite this, we often wrote columns in which we explained reasons with utter certainty." Duffy experimented with some predictions with respect to Mark Latham and Tony Abbott, but was disillusioned by Latham's unpredicted abandonment of politics. Duffy wrote "After this personal experiment I largely gave up the explanation business and wrote columns that were more descriptive, more about how things happened than why". Duffy draws on the book *Expert political judgment: How good is it? How can we know?* by American academic Philip Tetlock. Duffy said that Tetlock described the results of a 20 year study in which 284 experts in many fields, including economics and politics, are asked to make 28,000 predictions, and that the results proved only slightly more accurate than chance. Two points particularly emerge from these statements – Duffy does not trust explanations or predictions, which he equates with chance, and his writings are about politics and society. When Duffy's climate change opinion piece is examined in this light, it is fair to speculate not only that this complex subject, containing detailed explanations and predictions, triggers Duffy's personal feelings of distrust, but also that he is interpreting the debate as a social and political phenomenon, not as a scientific one. If Duffy equates the predictions of economists and political or social commentators with the calculated, empirical predictions of climate scientists, he is misunderstanding science.

Part of my reflection on Duffy's writing is to look critically at any anti-climate science opinion pieces and ask whether the opinion piece writer has stepped out of the realm of politics and society into a fundamentally different world of scientific analysis, and then misinterpreted the science because of this paradigm shift. That might make me a discerning reader, even a forgiving reader, but in the case of such virulent anti-science, we cannot let such published pieces pass unchallenged. It really is an editorial requirement to make sure that science is fairly reported, and that the criteria of verification and truth are met on the scientific side of climate change.

The issue of how the media report climate change is capturing wide attention, with scientists participating with increasing vigour in the debate. A good example is the piece on *The Conversation* website, as described below. It also serves as a good example of a topic in which scientists see science as being under siege and are standing up and defending the discipline, in this case, climate change.

"How the media gets it wrong on climate change"

On 24 June 2011, *The Conversation* ran a piece entitled: "The false, the confused and the mendacious: how the media gets it wrong on climate change"[9]. The authors were Stephan Lewandowsky and Michael Ashley, with contributors being David Karoly, Ian Enting, John Abraham, Michael J. I. Brown, Mike Sandiford and Ove Hoegh-Guldberg. The piece opened with the statement that climate change is caused by humans, and is both real and poses a serious risk for the future. *The Conversation* added that we have also revealed the deep flaws in the conduct of so-called climate "sceptics" who largely operate outside the scientific context. Under the subheading, "The phony debate on climate change", the question was addressed, "why is there resistance to action on climate change in Australia?" Two reasons were cited: firstly, there is "a handful of individuals and organisations who, by avoiding peer review, have engineered a phony public debate about the science, when in fact that debate is absent from the one arena where our scientific knowledge is formed"; secondly, "systemic media failures arise from several presumptions about the way science works, which range from being utterly false to dangerously ill-informed to overtly malicious and mendacious." This statement was immediately followed up by an explanation of the failures.

It is false to make the presumption, made by many in the media and the public, that climate science is a brittle house of cards that can be brought down by a single new finding or the discovery of a single error. Nothing could be further from the truth, the authors explain, in fact, climate science is a cumulative enterprise built upon hundreds of years of research. What is needed instead of the false symmetry implied by balance, the authors explain, is impartiality, i.e. reporting the facts and evaluating the evidence. An example of a dangerously ill-informed opinion, the authors explain, on how science works is the myth that scientists have a vested interest in climate change.

As scientists, the authors and their teams do not ask for special consideration by the media, but for the same editorial responsibility that is applied to the other arenas of public discourse. The authors emphasise that selective failure of quality control and editorial responsibility, when it comes to climate change, presents a grave public disservice. Finally, they point out, no truthful analysis of the Australian media landscape can avoid highlighting the maliciousness of some media organisations, and

9. http://theconversation.edu.au/the-false-the-confused-and-the-mendacious-how-the-media-gets-it-wrong-on-climate-change-15588h t t p : / / w w w . greenleft.org.au/node/46075

their distortion of scientists and scientific findings. The authors and their team state sharply that it is not a matter of legitimate editorial process to invert the content of scientific papers, to misrepresent what scientists say, or to prevent scientists from setting the record straight after the science has been misrepresented. Their brilliant closing line was: "The very fact that society is wracked by a phony debate where there is none in the scientific literature provides strong evidence that the Australian media has tragically and thoroughly failed the Australian public". This is a damning statement by a group of scientists who feel betrayed by the media, or at least powerful elements of the media, and are deeply concerned that the public is being deceived by malicious misreporting.

Academic interest in climate change journalism

Kris M. Wilson (2000), in his chapter "Communicating climate change through the media", made a strong point that most world citizens will not learn about climate change research from the cautious lexicon in scientific journals, but rather from the mass media. Increasingly, he said, it is the responsibility of the media to translate complex scientific concepts to a lay audience. Wilson added that, as well as the scientific and journalistic quagmire, there is the increasingly fractious political milieu of climate change, which has evolved into a scientific and political lightning rod that challenges us to make new connections among science and public policy and journalism. Wilson cited Henderson-Sellers (1989) saying that in Australia the media and politicians were most responsible for public confusion about global warming. Science training and background, he said, was found in a study to be less correlated with reporters' climate change knowledge than with being a full-time environmental specialist and using scientists as sources.

Tim Flannery (2005) asked the question of whether climate change is a terrible threat or a beat-up. Perhaps, he mused, it is something in between, an issue that humanity must face eventually, but not yet. He said the world's media abound with evidence to support any of these views. He added that perusing that same media makes one thing clear: climate change is difficult to evaluate dispassionately because it entails deep political and industrial implications, and because it arises from the core processes of our civilisation's success. Flannery said the stakes are high, and this has led to a proliferation of misleading stories as special interest groups argue their case. Flannery's observations can be applied to the material presented in this paper which covered the period between mid-2008 and the beginning of 2012. One implication is that media editorial policy is not keeping abreast of changing science or the implications of that science, with particular reference here as to what we need to do to conserve our wildlife, and what adaptations we need to make to manage the land and the species that are likely to be affected.

In his book *Scorcher*, published in 2007, Clive Hamilton attacked what he saw as the Howard government's lip service to action on global warming and the deceitfulness that accompanied this - the dirty politics of global warming. In summary, said Hamilton, we have a government that has allowed policy to be determined, even written, by the large corporations that have most to lose from change. In his blistering attack on vested interests and their often shadowy influence on the debate, Hamilton regularly referred to the media and the part it plays as the mouthpiece of those groups promoting climate change denial. One technique, Hamilton noted, was to undermine the credibility of the science by exploiting the public ignorance of how science works. Hamilton gave his own examples, but the debate in the *SMH,* as presented in this paper, provides ample evidence. In his chapter on the battle for public opinion, Hamilton noted that by the time that global warming loomed as the most alarming threat to humanity, environmentalism had given rise to its opposite, a virulently hostile coalition of industrialists, right-wing commentators and conservative politicians. Hamilton identified Michael Duffy as a right-wing broadcaster who featured Frank Furedi on his ABC radio program *Counterpoint* on 21 February 2005. Furedi, said Hamilton, had written a number of books that explore and denounce the excessive emphasis in Western culture on risk and danger, and although some these arguments are plausible and valuable, said Hamilton, there is a deeper purpose to them. A blanket criticism of over-sensitivity to risk, said Hamilton, is applied specifically to climate change, as if global warming were just another invention of "doom-mongers". Hamilton drew attention to Michael Crichton's novel *State of fear* which characterised global warming as a fabrication of nefarious environmentalists. Risibly, said Hamilton, in Australia, Michael Duffy used Crichton's novel as an authority for his own denialist position. Hamilton referred to Michael Duffy's piece "Putting the heat on global warming" in *The Daily Telegraph* of 25 December 2004. Hamilton's approach to the subject is to see the media as one facet of the dirty politics of climate change, and in doing so he focuses principally on the politics, and not the media. Nevertheless he does give credit to a handful of journalists who had been reporting issues for years, sometimes in the face of indifference or hostility from their editors. He named Claire Miller of *The Age*, Julie Macken of *The Australian Financial Review*, Sarah Clarke of ABC and, in more recent years, Wendy Frew of the *Sydney Morning Herald* as deserving recognition. Mention should be made of Murray Griffin, said Hamilton, the editor of the independent newsletter *Environmental Manager*, which had followed the issue closely for years, and Alan Tate of ABC and Gavin Gilchrist of the *Sydney Morning Herald*, who pursued the issue vigorously in the 1990s. Hamilton has since said his list should have included Robyn Williams of the ABC's Science Show (Hamilton, pers. comm. 2012). Although Hamilton's list of journalists ranges across a series of media outlets, the principle is the same that I elicited by focusing on just the *Sydney Morning Herald*, namely there are some fine journalists where direct acknowledgement of the quality of their reporting was in order, in contrast to right-wing commentators amplifying the denialist cause.

Stephen Schneider (2009), in his engaging book *Science as a contact sport*, felt strongly about this matter of media. He devoted a chapter to *The media wars: the stories behind persistent distortion*. One of the reasons for distortion in media reports on climate change, said Schneider, is the perceived need for "balance" in journalism. He took the view that in reporting political, legal or other advocacy-dominated stories, it is appropriate for a journalist to report both sides of an issue. In science, said Schneider, the situation is radically different, there are rarely two polar-opposite sides, but rather a spectrum of potential outcomes, often accompanied by a history of scientific assessment of the relative credibility of each possibility. Schneider made the point that being stereotyped as the "pro" advocate versus the "con" advocate for action on climate change is not a quick ticket to a healthy scientific reputation or as an objective interpreter of the science. Schneider says that, at public talks on climate change, he takes the time to explain the difference between climate deniers and sceptics. All good scientists are sceptics, he said, and we should challenge everything, but climate deniers are not true sceptics. They simply ignore the preponderance of evidence presented, which is at best bad science or, at worst, dishonesty. Schneider feels strongly about this subject when he says that it is disgraceful that the media allow routine distortions in complex system debates like climate change, as if a fact is somehow an "opinion", and all opinions should be aired. Schneider adds to that point by saying that to allow known falsehoods or misframings of science as an opinion is an error, or worse, and they should be distinguished from real opinions, i.e. value judgments on what we should do about it.

Fortunately, said Schneider, most sophisticated science and environment reporters have abandoned a model of polarisation of two sides, but this type of reporting still exists, especially where mainstream media are firing their science specialists. For their part, Schneider said, scientists can help by taking a more proactive responsibility for the public debate. They should do this by agreeing to weigh in on the climate change debate. Schneider then made the point that scientists do not make their reputations by repeating what is well-established, but rather by arguing at the cutting edge, where much speculation remains. Thus, any journalist looking for controversy need go no further than one of our scientific conferences to find out all they can scratch down on their notepads. Schneider suggested that we could improve public dissemination of scientific knowledge if we required our science graduate students to take a survey course of the public communication process, including the process of political advocacy and science policy formulation. Similarly, Schneider added, journalism schools could show the consequences of misapplying balanced reporting techniques, used in the political arena, to complex issues in which not all opinions deserve equal billing in a story.

Bud Ward (2009) opened his paper on journalism ethics and climate change reporting with the view that many veterans of traditional journalism stick to a well-established, if often abstract and unenforceable, code of professional ethics that compares favourably with the strictest such codes applicable to many other fields. Ward commented that non-journalists might find that surprising, given the frequent ethical lapses occurring in the media. Ward also noted that one of the common ethical principles in news reporting is that journalists cannot be both observers and participants in an event on which they are reporting. These ethical codes present a challenge to science journalists reporting on climate change, and even more so to opinion writers. While we can observe that the standards of journalistic ethics have been adhered to by the science reporters in the *Sydney Morning Herald*, it is the opinion writers in the same newspaper who do not appear to have met the simple criterion of seeking truth and reporting it. It raises the question of whether they are being participants rather than observers of the science of climate change. Under the sub-heading "the science change-journalism ethics equation", Ward wrote that instead of the notion of providing balanced reporting, journalists increasingly, and rightly, take their cues from the acknowledged scientific experts when it comes to the facts of global climate change. Issues of journalism ethics in dealing with climate change, said Ward, go much farther than that. Is it up to the reporters to sustain the clarion call by way of front-page headlines and repeated 'breaking news' alerts, despite, Ward asked, what some observers now dismiss as 'climate fatigue'? Isn't that too much like making, rather than reporting, the news, Ward also asked? Ward mused on how these ethical principles will play out in the coming years. He was firm when he said that what remains a certainty is that, without the acknowledged credibility a journalist needs to have a measurable impact on an issue as important as global climate change, interested citizens will have to turn elsewhere for information. Such strong writing is encouraging for those who have been more than irritated by the reporting of the science of climate change in the media.

The subject of ethics and the Australian news media is not new, as pointed out by Hurst and White (1994). Hurst and White stated that opinion poll surveys testify to public distrust and dissatisfaction with media performance with disturbing regularity. They cited a Time-Morgan poll in mid-1993 which awarded Australian newspaper journalists an ethics and honesty rating of 8%, well behind that given to politicians, and the only surveyed occupation to receive a lower score was selling used cars. They also cited an earlier Gallup poll in 1998 that found that three-quarters of Australians surveyed thought that stories were often inaccurate. Hurst and White concluded their book by arguing that a piecemeal approach in ensuring adherence to ethical standards does not satisfy the needs of the industry or the public. This means, they said, change at three levels: the individuals; the news organisations, and the industry as a whole. They concluded that change will require acceptance that ethical conduct really does matter to the survival of a free and robust media industry. One might readily add that science depends upon the survival of a free and robust media industry and therefore ethical conduct by everyone involved. This is not peculiar to climate change, but climate change science has been one subject that has been under siege from elements in the media.

In a powerful book entitled *Merchants of doubt: how a handful of scientists obscure the truth on issues from tobacco smoke to global warming*, historians Naomi Oreskes and Erik M. Conway (2010) devoted a chapter to "the denial of global warming". Towards the end of the chapter, after discussing the role of a number of senior scientists as climate change deniers, they comment on how the mass media became complicit and felt obligated to treat the issue as a scientific controversy. Journalists were constantly pressured to grant the professional deniers equal status, and equal time and newsprint space and, said Oreskes and Conway, they did. They added that editors evidently succumbed to the pressure, and reporting on climate in the United States became biased toward sceptics and deniers because of it. In their penultimate paragraph, they said that, in 2004, scientists had a consensus about the reality of global warming and its human causes, and had had this since the mid-1990s. Yet, the authors added, throughout this time period, the mass media presented global warming and its cause as a major debate. Their closing paragraph delivered a knockout statement. Oreskes and Conway said that the divergence between the state of the science and how it is presented in the major media helped make it easy for the US government to do nothing about global warming. In July 1997, they state, three months before the Kyoto protocol was finalised, US Senators Robert Byrd and Charles Hagel introduced a resolution blocking its adoption. Byrd-Hagel passed the Senate by a vote of 97 to 0. "Scientifically," Oreskes and Conway state, "global warming was an established fact. Politically global warming was dead." There could hardly be a clearer statement of the power of the mass media, particularly the print media, in warping science and thereby producing an appalling political, social and environmental outcome.

In an engaging, if quirky, book *Why we disagree about climate change: understanding controversy, inaction and opportunity*, Mike Hulme (2010) opened his foreword by recounting a bit of history that could only bring a wry smile to your face. He said that, when he first entered the field of climate change policy research a little over two decades ago, he was warned by a former deputy administrator of the US Environmental Protection Agency (EPA) that he was wasting his time because, "climate change will never be a major public policy issue". Hulme said that he had advanced three reasons in a statement: "the science is too uncertain, the impacts are too far in the future, and there is no readily identifiable villain". Hulme said that his response was that these were exactly the kinds of reasons why climate change would become a major policy issue, it was precisely the plasticity of climate change, its ability to be many things to many people, that would ensure its claim to sustained public attention. Hulme, not the former deputy administrator of the EPA, got it right. In his chapter, "The communication of risk", Hulme examined how the idea of climate change has been represented in the range of media contexts by scientists, by campaigning organisations, by governments and by advertisers. He pointed out that we need to understand the ways in which science, policy and the public meet through media-shaped narratives. He added that we need to understand who controls the narratives and the wider influence of what people believe about climate change and about its significance. In bold print, Hulme stated that "one of the reasons we disagree about climate change is that we receive multiple and conflicting messages about climate change and we interpret them in different ways".

Hulme summarised the work of communication scientist Anna Carvalho[10] to explore the relationship between the ideologies of three national UK newspapers, *The Times*, *The Guardian* and *The Independent*, and their coverage and representation of climate change during the period 1995-2001. She found significant differences between coverage in *The Times* and the other two newspapers. The *Guardian* and *Independent* gave great weight to scientific assessments of climate change risks and demanded stronger government intervention. *The Times* favoured a greater emphasis on scientific uncertainty about future risks and adopted a more liberal, market-oriented view of potential policy options. Similar differences were found in national American newspapers. The conclusion drawn was that the newspaper media therefore actively shape stories about climate change.

In a striking address on 6 October 2011 entitled "Science in contemporary Australia"[11], the Chief Scientist of Australia, Ian Chubb, discussed science and education. He was emphatic when he stated that all science risks damage when some science is attacked. "Today climate change", he said, "and tomorrow who knows". Chubb said that climate change is the leading example because it is the very core of science that is being attacked, its principles, its processes, its standards, its ethics and its people. Chubb says that the Royal Society captured this point in their 2010 report: "Like many important decisions, policy choices about climate change have to be made in the absence of perfect knowledge." "Climate science – including the substantial body of knowledge that is already well established and the results of future research – is the essential basis for future climate projections and planning, and must be a vital component of public reasoning in this complex and challenging area".[12]

Despite its inherent rigour and substance, Chubb said, the value, and indeed the very integrity of science, is being widely questioned. That is hardly surprising, said Chubb, when you read some of what has been written. If you believed it, said Chubb, you would believe that climate scientists, whose work supports the evidence that human activity is contributing to climate change, are cheats and frauds and worse. Chubb responded clearly by saying that if science and the associated values and institutions we

10. Carvalho's (2007) paper is forthright, such as the opening sentence: "The media have a crucial responsibility as a source of information and opinions about science and technology for citizens." This was followed by an epigrammatic sentence to lead the second paragraph: "Like any other dimensions of reality, science is reconstructed and not merely mirrored in the media."

11. http://www.nteu.org.au/article/Ian-Chubb-delivers-inaugural-NTEU-Lecture-12002

12 .Chubb cites the Royal Society (September 2010), Climate change: a summary of the science, the Royal Society, United Kingdom.

hold dear are under threat, it is not enough to cry foul and lament that dark forces are at play. Chubb takes the view that we must accept that part of the decline in trust is our fault – as scientists, researchers and scholars we are the guardians of science. Chubb argued that we need to be advocates. He recognised that for many in the media and politics and the plethora of so-called commentators, undermining science is becoming an increasingly popular pastime. Chubb said that the other day he read that a very large fraction of Australian primary teachers feel unqualified to teach science, and a large fraction of the Australian teachers of year 7-10 general science had not completed the generally-accepted standard of tertiary education in science. It is hard to encourage people, said Chubb, to defend science or not be afraid of it when, from a young age, they had been taught by people who are not confident with it. Chubb said, "we simply must do more to support our teachers and more for our students".

Howard launches 'anti-global warmist manual'

Radio journalist Lexi Metherell reported this story on 13 December 2011[13] for ABC's program AM. AM's anchor was Tony Eastley. What follows is an edited version of the report, to reduce its length for the printed word:

Eastley: "The former Prime Minister John Howard has lent his support to a book which argues the theory of human-induced global warming is a scam. Last night the former prime minister, who once supported an emissions trading scheme himself, launched the publication, the work of geologist Professor Ian Plimer. The book, called *How to Get Expelled From School*, rejects the predominant scientific opinion on climate change. AM's Lexi Metherell went to the book launch at the Sydney Mining Club."

Metherell: "*How to Get Expelled from School* is Professor Ian Plimer's follow up to his book *Heaven and Earth*. The new work includes 101 questions for students to use to challenge their teachers on climate science."

Plimer: "After *Heaven and Earth* came out I had many parents write to me to say, look, what do we do, our kids are being fed activism? I want my children to have the basics of science, I don't want them to be fed activism."

Howard: "The progressive left has got their grip on the commanding heights of education instruction in this country."

Metherell: "The book is billed as, quote, 'an anti-global warmist manual for the younger reader'."... "Mr Howard says he's become increasingly interested in the climate change debate because of the persistent attempt, he says, to silence dissent."

Howard: "The epitome of the corruption of the language in this debate is the use of the word 'denier'. And we all know that when you use the word denier in the context of any generation represented in this room, you are talking about people who denied the deaths of 6 million Jews in the Nazi extermination camps."

Given the difficulties of teaching science in school, as outlined by Chief Scientist Ian Chubb, Plimer has targeted this area of science which was in urgent need of strengthening, not undermining. It appears that former Prime Minister John Howard has backed Ian Plimer in undermining teachers.

It was already evident that Ian Plimer was the expert of choice for opinion writers in the *Sydney Morning Herald* who are hostile to the scientific reality of human-induced climate change. Now, with the endorsement of a former Prime Minister, it will encourage the anti-global warming opinion writers to pursue their hostile vision of not only the subject, but the very core of science itself. Science remains under siege when school teachers are undermined in teaching science, when climate change deniers are promoted by former Prime Ministers and, as Ian Chubb said, when scientists themselves do not become the guardians of their discipline and advocates for it. The Royal Zoological Society, in its forums *Science under siege* and *Wildlife and climate change* and the publications from these forums, has rallied to that cause.

Concluding remarks

A conclusion that can be drawn is that if one were to use only the *Sydney Morning Herald* for a grasp of the science of climate change, that grasp would be weakened and potentially distorted, not by the science journalists, but by the political agendas of the opinion writers. If most people learn about the difficult topic of global climate change from the media, such as the *SMH*, and take their lead from media commentators and opinion writers, then the obvious inference is that we have a huge challenge on our hands to move the public, and thus political and bureaucratic decision-making, into a higher gear to conserve our native wildlife in the face of climate change. This conflict over what position to take becomes even more challenging if there are intense political differences on the matter, as is the case with climate change in the Australian Federal Parliament. The remedy includes scientists developing media skills and speaking up, and newspapers employing more journalists who are science-trained, or interested in science and the environment, and willing to cover a subject so that its depth and the process of arriving at conclusions is more apparent. This requires a shift in editorial policy towards verification and truth as criteria for opinion writers, as well as the science journalists. This can be achieved; it will both make science more enjoyable, and show that climate change is part of our mainstream science culture, not an odd cult within it.

There are three issues to consider here if we are to adapt to cope with climate change. The first is to ask why a public debate even exists about whether climate change, particularly anthropogenic climate change, is occurring or not, given the quality of the science underpinning the subject. The discerning reader on the climate change debate could detect that the scientific consensus is too conservative and not, as often touted, that the climate change science itself is suspect. The second is that there is not a clear public

13. http://www.abc.net.au/am/content/2011/s3389508.htm?, last accessed 21.1.12

perception as to how climate change will affect biodiversity, with biodiversity being a difficult word in itself because it is so broad. Wildlife is arguably a better known term, and one that can encompass places where native animals live, in ecosystems as diverse as forests, wetlands and coral reefs. Wildlife was the word used in the RZS forum of 2010 on *Wildlife and climate change*, and the book that followed (Lunney and Hutchings 2012a). Thirdly, if we do take action, where do we put our efforts to conserve wildlife in the face of such a universal problem? The immediate response of many educators is to recommend that you learn about the topic, and form your own opinion from critical reading and discussion. This paper has contributed to this approach through critical comment on the media as a source of information about climate change.

One suggestion for prospective science students, and practising scientists who would like to develop media skills, is displayed in the graduate and undergraduate Science Communication courses offered by the Australian National Centre for the Public Awareness of Science at the Australian National University. A 2011-2012 undergraduate course description, *Science in the Media*[14], states that: "Public surveys have shown that more Australians prefer to read about science in the newspapers than sport. However, very few scientists are trained in the skills of writing for the general public and many also avoid any contact with the media. For the public to be able to make informed decisions about important scientific issues, they need to have access to accurate yet understandable information. The best vehicle for this is through the print and electronic media." "This course examines the relationship between science and the media and the cultural differences that often make the relationship difficult. Topics to be covered include an analysis of science-media relations from both the scientists' and journalists' perspective; the style in which science is reported in the media; and how best to present science in the media. This is a skills-based course, the aim of which is to train science students in the production of material suitable for publication or broadcast in the popular media. Students will have direct contact with working science writers and other members of the media to give them the opportunity to have stories printed or broadcast."

There is no doubt that such interdisciplinary courses are invaluable, but more needs to be done. By the time the new graduates from these courses are given the journalistic freedom to write intelligent pieces, many years will have passed and some poor science writing will have occupied prime places in important newspapers. If Davies (2008) is right, then the new graduates in science and the media will struggle to find the time, or more correctly be allowed the time, to explore such complex subjects as climate change. This exploration also needs to follow its implications for managing the environment and the major policy decisions necessary to deal with the ramifications on the environment of the impacts of global warming. We also need a more thoughtful editorial approach to science, even if the conclusions do not sit well in the commercial world and the power clash in the political arena. There are, in fact, many first-rate scientists speaking up, and their voices are most welcome. However, there does need to be a change of media policy to cope with the difficult issues that science throws up, and to recognise that science is a central part of society, and not a subject that can be selectively picked over for the benefit of one group or another.

Science communication, especially on socially difficult subjects, can be a tough field. The 'climategate' saga in the media, immediately prior to the Copenhagen talks in December 2009, showed the damaging impact of poor science communication, and the consequences of intemperate, or careless, language by scientists, or being too secretive[15]. The 'climategate' controversy presents a fascinating insight into how climate change deniers attack individual scientists, and the institutions in which they work, as well as the length of time it takes to restore public confidence. The important point here is the way in which the science is communicated, and the role of scientists in that activity. Poor communication by scientists, even in emails, as has been shown by the massive apparent falsified data scandal that emerged in the latter part of 2009, is damaging, even when subsequently found not to be the case after a series of public enquiries.

Climate change has been one of the dominant and persistent media stories of the last few years. With such a high profile, a conscientious follower of the news who is also interested in wildlife would expect to see reports, comments and opinions on the impact of climate change on our fauna and what we might do to alleviate the stress. That there is a dearth of such material may come as a surprise to many. Should this brief account of the way the media has dealt with the climate change/wildlife nexus, namely to simply state that it has hardly been dealt with, be the end of the story? The scarcity of direct climate change-wildlife articles raises a number of serious issues. These include the problem of communication of what science has been done, the likelihood that there are too few studies directly on the subject of wildlife in the field, that much of the research to date has been on modelling, and that the predictions of a dire future are falling on either deaf or untrained ears. Further, most of the research has been at the ecosystem level, not species, and drier, hotter scenarios do not seem to translate into direct impacts on wildlife, other than polar bears, in the public mind. There is also the difficulty of working within just one discipline, in this case just science or just journalism. This paper examined the problem so that the dominant environmental theme of climate change and a matter of pressing interest to zoologists, the future of our fauna, can become more integrated, and more interesting to a wide audience.

14. http://studyat.anu.edu.au/courses/SCOM3002;details.html, last accessed 21.1.12

15. The stories about climategate are readily available on the web. A good summary is "Climategate scientists cleared by British enquiry". The ABC news report of 8 July 2010 opened with: "The scientists whose leaked emails sparked a heated debate and speculation over the quality of research into climate change have been cleared by an independent inquiry in Britain. The six-month inquiry cleared the climate scientists of accusations that they manipulated their data, but criticised them for being too secretive and defensive about their research."http://www.abc.net.au/news/2010-07-08/climategate-scientists-cleared-by-british-inquiry/896494, last accessed 21.1.12

Curthoys (1999), writing about the history of journalism, pointed out that print journalism has been a vital element of Australian life for almost two centuries, and despite the many changes in the nature of print journalism, politics has remained its principal focus. Salter (2007) offered his views on journalism in his book, *The media we deserve*, by saying that the print and broadcast material we consume every day is diverse, perverse, distracted, uneven, logically inconsistent, infuriatingly opportunistic, often crassly commercial, insufferably pretentious and rarely witty. But, Salter added, it is also generally competent and occasionally very good indeed. His book, he said, was intended to untangle that knot of contradictions. Journalism, he said, is a perfectly reputable craft, but the problem was the disreputable things that journalists, their editors and producers sometimes do. Neither Curthoys, an historian, nor Salter, a journalist, covered climate change, but their general points encapsulate most of the important issues about climate change journalism touched on in this review. However, the subject of science journalism, and the reporting and opinion writing on the science of climate change in particular, does not fit neatly within the general pattern they described. It is a subject area that warrants more focus because of its importance for society at large, and to allow intelligent, informed political decisions to be made as to how to respond as a society. If the subject matter of science, and the quality of science reporting, does not come into clearer focus for the media, it will either be selectively set aside as not being important for editors or journalists, or it will suffer the distortions identified by Salter. It is hard for the non-scientist reader to untangle the knot of contradictions on this subject. Hence there is a need for a sustained, high standard of science journalism, with climate change being the current test case.

The media is a potent force in contemporary society, so when one strand takes an anti-science stand, or one editorial line within a newspaper in relation to opinion pieces but not to science journalism such as has occurred over the last three years in the *Sydney Morning Herald*, it is extraordinarily hard to disentangle what is being said by the scientists and where the truth of the matter might lie. The title of this paper is; "What's the difference between climate science and climate journalism?" Journalism professor Jay Rosen answered his own question by saying that: "The former is self-correcting, the latter has become self-destructive". Rosen also remarked that, "You must realize that having to portray an illegitimate debate fries the circuits of the mainstream press". This paper found support for Rosen's view, but with a caveat. The science journalism in the *Herald*, including the science writing on climate change, was not self-destructive. It was instructive, interesting and the presentation was engaging. The destructive element was by the opinion writers, either challenging the science outright, or promoting just one scientist, particularly Ian Plimer. One could extend Rosen's thesis to add that the illegitimate debate has fried the circuits of mainstream press, and some high-profile political figures, some letter writers, and no doubt many readers. The fried circuits of the mainstream press, in this case the *SMH*, are evident in a policy that has allowed unverified views to be promulgated as informed opinion, as the truth no less, while at the same time publishing sound science from investigative journalists. Thus the modification to Jay Rosen's thesis is that a media outlet's credibility is self-destructive when two incompatible journalistic policies are pursued within the one organisation. The Orwellian doublethink appears to have been alive and well in the two diverging strands of science and opinion journalism in the *SMH* in relation to climate change.

In contrast to such glum conclusions of the preceding paragraphs, this author delighted in the intellectual rigour and excitement of a challenge that has been accepted by journalists themselves, by scientists, and by members of the community. On sheer volume alone, the climate change deniers and their journalistic companions are in a tiny minority. It is not only a matter of getting the balance right between the overwhelming majority who understand that climate change is a serious issue and that we need to address it, compared with the tiny minority of deniers and mischievous journalists either promoting their own views or those of fringe scientists. The issue is more fundamental, it is one of adherence to established journalistic ethics, and the fundamental principles of competent reporting.

If one looks at the rules of the game for journalists, the curious question arises as to why so much space is given to so few people to promote such unsound science. That is not the question being investigated here, it is the study of what did appear in the media, but it does point to a more fundamental problem, that many people consider concern for the environment to be an impediment to economic progress, and thus want to be selective in their acceptance of science, using convenient technology, but ignoring the science that points to its unwanted consequences.

In the context of this book, the most striking conclusion that can be drawn is that science is under siege, and zoology is under threat, when a major media outlet allows impoverished science writing in the form of opinion pieces to gain space where nearly a million people are likely to read the article. To try to discredit both the science and scientists who work on climate change undermines our capacity to adapt our management approaches for fauna as the climate changes. To zoologists, this is no trivial matter. Thus, opposition to an intelligent appreciation of science, its methods, and the presentation of differing viewpoints among scientists in the field of climate change, imperils our already threatened fauna. It follows that if we are to protect our fauna against climate change, then we need to work on the best science, and with community support. If some journalists, and some strands of editorial policy, decide for various reasons to discredit climate change science and its specialists, then it is necessary for zoologists, conservation biologists, and ecologically-minded members of the community to speak up and challenge such brazen anti-science journalism and such unacceptable editorial policy. This paper is one contribution to that view.

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