

Chapter 6

New and emerging mitigation and deterrent measures

6.1 This chapter begins the report's examination into alternatives to established mitigation and deterrent measures. In doing so, this chapter focuses on new and emerging technologies, while the next chapter considers other approaches such as education.

6.2 Although the committee's focus is on particular categories of new and emerging technologies, such as personal deterrents and eco barriers, examining these categories necessarily involves discussing specific products within each category. This chapter outlines the evidence received to indicate how it informed the committee's consideration of the overall direction of research into new products and what categories of new and emerging technologies appear to have the greatest potential for increasing public safety.

6.3 The committee received evidence from companies involved in the research, development and/or sale of these products; understandably, these companies presented the strongest possible cases for their particular product or idea. Claims about the efficacy of particular products are presented in this report at face value, as it is not the role of the committee to select and promote a particular company or product over another. Consumers interested in this category of products should research and review the specifications carefully to ensure any product they select is suitable for their requirements.

Overview of new and emerging technologies

6.4 A 2015 report prepared for the New South Wales Department of Primary Industries (DPI) by Cardno identified several four categories of emerging shark deterrent and detection technologies. These categories are as follows:

- large-scale deterrents, which include a range of barriers that separate water users and sharks;
- personal deterrent devices;
- detection technologies, a category which includes land-based observer programs, acoustic and satellite tagging and tracking of sharks and sonar-based shark detection technologies; and
- SMART (Shark Management Alert in Real Time) drum lines.¹

1 Cardno, *Shark deterrents and detectors: review of bather protection technologies: Report prepared for the NSW Department of Primary Industries*, October 2015, www.dpi.nsw.gov.au/data/assets/pdf_file/0020/621407/cardno-review-of-bather-protection-technologies.pdf, pp. 3–4, 17. Pages 4–17 of the report provide an overview of each technology and discusses available evidence about their effectiveness.

6.5 Essentially, the emerging technologies seek to provide an effective safety product for water users while addressing some of the negative consequences of existing lethal measures, such as the impact lethal measures have on the marine environment. This point was well made by the Australian Institute of Marine Science (AIMS), which advised that a key advantage of new and emerging technologies is that they can address 'the conflict between species protection and human safety' that is inherent with lethal measures. AIMS noted that this conflict 'is likely to increase' as sharks are 'increasingly recognised as species of conservation concern'. Over time, it is expected that further species of sharks will be added to international treaties such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Bonn Convention and, therefore, provided with national and international protections.²

6.6 Although there is a range of alternative shark deterrent and mitigation measures at various stages of development, this chapter discusses the alternative measures that received significant attention during this inquiry. The first measure discussed are the SMART drum lines, followed by aerial surveillance, other surveillance programs (including land-based shark spotting programs, tagging programs and sonar technology), beach enclosures and eco-barriers, and personal deterrent products.

SMART drum lines

6.7 SMART drum lines are a new measure used in New South Wales. According to the DPI, SMART drum lines 'differ greatly from traditional drum lines as they are not designed to kill sharks'.³ The committee was advised that drum lines use circle hooks which allow sharks 'to move around in a circle; therefore, [the hook] allows water to get into the gills and oxygenate the shark'.⁴ When a shark is captured, a response team is alerted and responds to 'tag and potentially relocate the shark'. The SMART drum lines used in New South Wales are 'only deployed when a team is on hand for immediate response'.⁵ In addition, mullet is used as bait with the aim to 'reduce the attraction of, and interaction with, other marine mammals (whales, dugongs and dolphins), seabirds and marine reptiles (turtles)'.⁶

2 Australian Institute of Marine Science, *Submission 49*, p. 6.

3 New South Wales Department of Primary Industries (DPI), 'Shark management', www.dpi.nsw.gov.au/fishing/sharks/management (accessed 5 December 2016).

4 Ms Natalie Banks, Chief Advisor, Sea Shepherd Australia, *Committee Hansard*, 20 April 2017, p. 16.

5 DPI, 'Shark management'.

6 Correspondence from Dr Geoff Allan, Deputy Director General, DPI, to Ms Kim Farrant, Department of the Environment and Energy (DoEE), dated 6 October 2016, pp. 1–2, tabled by the DoEE, Supplementary Budget Estimates 2016–17, 21 October 2016.

A DPI Fisheries research program involving 15 SMART drum lines conducted between August 2015 and 30 September 2016 resulted in the capture of 34 white sharks and 15 bull sharks, all of which were tagged and released alive. During this period, only two non-target species were caught, and both were also released alive. As a result of these findings, on 2 October 2016 the New South Wales Government announced that it would use an additional 85 SMART drum lines.⁷ As at July 2017, 35 SMART drum lines were allocated to the north coast, with a further 50 to be trialled off beaches in off beaches in the Shellharbour-Kiama, Shoalhaven, Mid North Coast, Forster and Byron Bay regions.⁸

6.8 SMART drum lines have been successful in catching sharks when compared to traditional lethal measures—Dr Daniel Bucher and Professor Peter Harrison observed that 'in one day during January the SMART drum lines caught as many sharks as the nets caught in the entire month'. Dr Bucher and Professor Harrison also noted that bycatch on SMART drum lines is low and although the 'method of hooking a large shark by its mouth and dragging it further offshore does raise some cruelty issues, but short-term post-release survival rates are good'.⁹ Overall, Dr Bucher and Professor Harrison concluded:

Although we prefer to support observational and warning strategies rather than shark removal options, it is clear that smart drumlining is a more effective and far less destructive method to remove dangerous sharks from beaches than nets...¹⁰

6.9 Humane Society International (HSI) has a 'cautious open mind' towards SMART drum lines.¹¹ Provided that strong monitoring continues and the technology does not adversely affect any marine species, HSI considers that the drum lines 'could be a possible non-lethal replacement for nets'. Ms Jessica Morris from HSI explained the factors that informed this conclusion as follows:

We did have concerns when we first heard that they were going to be used, because the only trials that had been done were at Reunion Island. At the time, we were very much concerned for hammerheads because, even though they are a non-target species, they are captured on drum lines. And then the post-release mortality was a big concern for us, because they are very susceptible. The Reunion Island's trial showed that hammerheads were dying within the two-hour period that they have to come out and

7 Correspondence from Dr Geoff Allan, DPI, to Ms Kim Farrant, DoEE, dated 6 October 2016, p. 2, tabled by the DoEE, Supplementary Budget Estimates 2016–17, 21 October 2016.

8 The Hon Niall Blair MLC, 'NSW gets SMART on sharks', *Media release*, 3 July 2017.

9 Dr Daniel Bucher and Professor Peter Harrison, *Submission 23*, pp. 5–6.

10 Dr Daniel Bucher and Professor Peter Harrison, *Submission 23*, pp. 5–6. A similar conclusion was reached by Ms Kathrina Southwell, General Manager, Australian Seabird Rescue. See *Committee Hansard*, 2 May 2017, p. 67.

11 Ms Nicola Beynon, Head of Campaigns, Humane Society International (HSI), *Committee Hansard*, 17 March 2017, p. 40.

unhook them, and some animals were being eaten on the drum lines before the contractor could come out and take them off. We did have concerns initially, but so far in New South Wales, with DPI running it, there have been no mortalities from the SMART drum lines. But we were worried, because there were a few great hammerheads caught. If they are not tagging these non-target species we do not know if they are going off and dying as a result.¹²

6.10 Representatives of Sea Shepherd made similar comments. Ms Natalie Banks stated:

The smart drum lines have caught various shark species in New South Wales. They have tagged and relocated those sharks, which allows us to get evidence that those sharks are surviving, because the tags are being picked up and their data analysed. If Western Australia was to look at SMART drum lines, it would be something that I would not be as vocal about as I was about a static drum line that does not allow a shark to move around.¹³

6.11 However, other stakeholders on either side of the argument about the current need for lethal measures expressed scepticism about the merits of SMART drum lines. The Sunshine Coast Environment Council submitted that the measures are questionable on animal ethics grounds and their contribution to public safety:

Although 'Smart' drum lines provide a degree of research benefit, they still harm marine life and provide the same false sense of security as standard drumlines and nets. Given the small number of sharks tagged, this cannot be considered a major solution or enhancement to ocean-user safety. Likewise, animals susceptible to stress related death like that of the Hammerhead species have a significantly reduced chance of survival once released.¹⁴

6.12 Individuals who consider lethal drum lines are successful were critical of the tag and release approach used by SMART drum lines. Mr Donald Munro commented:

The only problem is that that shark is still released. No matter how far off the shore they tow them, they can end up coming back if they are of a mind to—and they are. Tagged or not, they are still a risk to ocean-goers. It is a double-edged sword, that one.¹⁵

12 Ms Nicola Beynon, Head of Campaigns; Ms Jessica Morris, Marine Scientist, HSI, *Committee Hansard*, 17 March 2017, p. 40.

13 Ms Natalie Banks, Sea Shepherd Australia, *Committee Hansard*, 20 April 2017, p. 16.

14 Sunshine Coast Environment Council, *Submission 35*, p. 7.

15 Mr Donald Munro, President, Le-Ba Boardriders; and Spokesperson, Lennox Head National Surfing Reserve, *Committee Hansard*, 2 May 2017, p. 2.

6.13 Mr Alan Baldock stated:

They are releasing them from the SMART drum lines. I watch them from the beach with binoculars. I have seen huge sharks getting released only about 200 or 300 yards off the beach. What is the sense in that?... You say, 'What are you letting it go for? Come on! You have a chance.' There are families swimming there.¹⁶

Advances in aerial surveillance

6.14 As discussed in Chapter 3, fixed wing and helicopter aerial patrols are a long-established tool for shark spotting with four aerial patrols currently in use in Australia that are dedicated to bather protection.¹⁷ Although the method is fundamentally not new, evidence was received about how technological advancements could improve shark spotting, particularly by improving spotting rates across a wide range of conditions.

Multispectral and hyperspectral imagery

6.15 Mr Duncan Leadbitter, Director, Australian Aerial Patrol, discussed how hyperspectral scanners could enhance detection efforts where the clarity of the water is an issue or to address reflections from the water—essentially, the technology could help 'the human eyes to look deeper into the water'. Mr Leadbitter advised that, although funding for research into this technology has been made available, his organisation has been unsuccessful in obtaining funding to deploy the technology on aerial patrols.¹⁸

6.16 The committee was also referred to multi-spectral camera technology that 'can eliminate the limitations inherent in detecting animals solely in the visible wavelengths of light'.¹⁹ Specifically, the committee received evidence about a product called Shark Alert, which uses a 'multispectral camera to look at sharks in deeper water than the current technology'.²⁰ The managing director of the company behind Shark Alert, Mr Chris Gurtler, described the technology as being 'an innovative method to detect sharks over a wide area, deep below the water surface, using military grade multispectral technology'. Mr Gurtler added:

The technology was originally designed for the US navy to detect Russian submarines. We have now customised it to detect sharks at depth in the ocean...Our system of protection includes a suite of technologies from

16 Mr Alan Baldock, *Committee Hansard*, 2 May 2017, p. 12.

17 Australian Aerial Patrol, *Submission 6*, p. 9.

18 Mr Duncan Leadbitter, Director, Australian Aerial Patrol, *Committee Hansard, Committee Hansard*, 17 March 2017, p. 21.

19 Associate Professor Daryl McPhee, *Submission 58*, pp. 5–6.

20 Dr Craig Blount, Senior Environmental Scientist, Cardno (New South Wales/Australian Capital Territory) Pty Ltd, *Committee Hansard*, 17 March 2017, p. 14.

radiometric and algorithmic analysis detection, transition of shark details and type to public notification via our partner app Dorsal. We have designed a waterproof smart watch for surfers that will run our notification platform, enabling them to simply leave the water when a dangerous shark is nearby.²¹

6.17 Dr Craig Blount, a senior environmental scientist with Cardno, who has reviewed the Shark Alert technology, noted that it addresses the problem of only being able to detect sharks that are on or near the surface. He added, however, that like any aerial survey, multispectral camera technology is limited to temporal coverage; that is, 'they fly over once and that is it'.²²

Unmanned aerial vehicles

6.18 Although new and emerging technologies may assist traditional aerial patrols, most of the evidence received in this area related to the potential for unmanned aerial vehicles (UAVs), which are more commonly referred to as drones.

6.19 Some submitters highlighted, and were optimistic about, the potential for drones to assist with efforts to reduce the risk of humans encountering dangerous sharks. For example, Australia for Dolphins included the following observations about drones in its submission:

Drone technology is growing at a rapid pace, and a recent trial in 2016 of the Westpac-funded "Mini Ripper" drone was found to be very effective. The drone is fitted with a video camera, loudspeaker and an emergency pod containing lifesaving equipment capable of being dropped into the ocean remotely.

Further research is currently being conducted at Sydney's University of Technology to fit the drone's video camera with specific software that would give it the ability to recognise a shark in the water.²³

6.20 Surf Life Saving NSW and Australian Lifeguard Service NSW explained that Surf Life Saving NSW has been involved in trials of drones in various locations in New South Wales and that individuals involved in both organisations have undertaken UAV pilot training to further develop 'capacity for enhanced beach surveillance and response'.²⁴

21 Mr Chris Gurtler, Managing Director, Shark Alert, *Committee Hansard*, 20 April 2017, p. 51.

22 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 14.

23 Australia for Dolphins, *Submission 4*, p. 3.

24 Surf Life Saving NSW and Australian Lifeguard Service NSW, *Submission 15*, p. 7.

6.21 Associate Professor Daryl McPhee argued that drones 'will more than likely' replace the 'traditional approach of using people in planes and helicopters to spot sharks', which he considered is 'outdated'. The associate professor added:

Which drones are optimal and protocols around their use are part of ongoing investigation, but their use is likely to become more widespread and their efficacy improve.²⁵

6.22 The cost associated with drone technology also appears to be decreasing. The Mayor of Ballina Shire Council, Cr David Wright, referred to a drone that initially cost \$100,000 but now costs less than \$10,000. This includes a camera that was \$30,000 but is now \$800 'and completely waterproof and thermal and everything'. Cr Wright remarked that the drone technology 'is changing so quickly'.²⁶

6.23 The potential for drones to support other lifesaving measures was noted. For example, Greenpeace, which called for funding to be provided for trialling drones as well as for other research programs, stated:

There is potential for drones to be used to supplement shark spotting efforts by identifying sharks from above the water. If drones are found to work effectively, they could be a great additional resource for shark spotters and surf lifesavers. If the drones have a high success rate, they could eventually replace the Shark Spotters Program.²⁷

6.24 However, it was noted that some of the challenges and limitations associated with traditional aerial surveillance similarly apply to drone surveillance. Dr Christopher Neff submitted that:

...the use of drones, helicopters, shark spotters, and fixed wing aircraft all rely on the proper weather conditions and the public should be informed that cloud cover, white caps, sun glare, the type of shark, position of the shark, and size of shark can all affect visibility.²⁸

6.25 In addition, the use of drones may encounter unique challenges. The Australian Aerial Patrol submitted:

Drones as currently developed have some significant operational limitations such as time of flight (an hour for high end drones), range (experimental drones can travel about 40km but off the shelf solutions have far smaller ranges) and vulnerability to wind (a major issue on the coast in summer), amongst other issues.²⁹

25 Associate Professor Daryl McPhee, *Submission 58*, pp. 5–6.

26 Cr David Wright OAM, Mayor, Ballina Shire Council, *Committee Hansard*, 2 May 2017, p. 21.

27 Greenpeace Australia Pacific, *Submission 50*, p. 17.

28 Dr Christopher Neff, *Submission 48*, p. 5.

29 Australian Aerial Patrol, *Submission 6*, p. 10.

6.26 Dr Jan-Olaf Meynecke, who spoke positively about drone technology and the ability for it to replace the more expensive traditional aerial surveys, noted that in perhaps ten years' time automated drone systems could be capable of sending alerts to surf lifesavers. However, Dr Meynecke noted that there are potential safety issues associated with the technology, such as 'if they just fall from the sky and hit someone'.³⁰

6.27 Sea Shepherd referred the committee to an article co-authored by a senior research scientist at the DPI and researchers at Southern Cross University. The article identified five major issues that drones need to overcome. These issues are as follows:

- civil aviation regulations;
- public safety concerns;
- public privacy concerns;
- the reliability of hardware; and
- the development of purpose-designed software that automatically detects sharks with a high level of accuracy.³¹

6.28 It was also noted that in order for drones to be effective, people are needed to operate the drones and monitor the video footage. Mr Andy Kent, Lifesaving Manager, Surf Life Saving NSW, explained that resources for surf lifesaving are already limited, regardless of whether the resources are provided by council or on a volunteer basis.³² This is significant because, as Mr Leadbitter observed, 'the drone does not spot the sharks: it is the person who is watching the screen'.³³

Information collected from tagging programs and sightings

6.29 Shark tagging programs aid research into shark movements and behaviour and are also intended to support public safety efforts by enabling the identification of individual sharks that approach the coast and areas of higher risk for water users generally.³⁴ The tags used include fin-mounted satellite tags and surgically inserted

30 Dr Jan-Olaf Meynecke, *Committee Hansard*, 31 July 2017, p. 12.

31 See Sea Shepherd Australia, *Submission 57*, p. 44. The article cited is B Kelaher, A Colefax, B Creese, P Butcher and V Peddemors, 'How drones can help fight the war on shark attacks', *The Conversation*, 3 February 2017.

32 Mr Kent observed 'If it is the council paying for the lifeguard services, that is at less cost to council; if it is us providing volunteers, it is less volunteer time'. Mr Andy Kent, Lifesaving Manager, Surf Life Saving NSW, *Committee Hansard*, 16 March 2017, pp. 15–16.

33 Mr Duncan Leadbitter, Australian Aerial Patrol, *Committee Hansard*, 17 March 2017, p. 21.

34 Associate Professor Daryl McPhee, *Submission 58*, p. 3; DPI, 'Shark tagging', www.dpi.nsw.gov.au/fishing/sharks/management/shark-tagging-project (accessed 1 June 2017).

acoustic tags.³⁵ The committee received evidence that highlighted how tagging programs can help improve the understanding of shark movements and behaviour. CSIRO submitted that it:

...works with a variety of State government and university-based research teams to achieve a broad coverage of tagging and genetic sampling of white sharks. This supports research into a national-scale understanding of their movements, behaviour and population status. Such information also helps with the interpretation of human-shark interactions and can inform assessments of the efficacy of both shark control programs as well as shark detection and deterrent devices.³⁶

6.30 The tagging programs are linked to other shark management measures including SMART drum lines (sharks hooked on SMART drum lines are tagged where possible) and public safety websites and social media accounts that publicise when tagged sharks are detected near the coast. These online services include government-operated social media accounts, social media accounts operated by surf lifesaving organisations and dedicated apps such as Dorsal. At one beach in Western Australia, when a tagged shark is detected this information is used as part of a system of alarms and flashing lights that is active when the beach is not patrolled.³⁷

6.31 A significant number of people refer to the information distributed as a result of tagging programs and public shark sightings. Mr Alan Bennetto from Dorsal advised that approximately 100,000 people use the Dorsal app. The users of Dorsal's social media sites total around 250,000 people.³⁸

6.32 Dr Christopher Neff commented that shark tagging programs which provide the public with real-time information on sharks can 'reduce the underlying levels of risk and make beach-going safer'. Dr Neff continued:

A good example of this is the education provided to the public by scientific shark tags, which highlight shark movements year round, and from which information can be displayed accessibly on smart phones. I recommend

35 DPI, 'Shark tagging', www.dpi.nsw.gov.au/fishing/sharks/management/shark-tagging-project (accessed 1 June 2017). For a description of how the tagging system works and the information collected, see Professor Jessica Meeuwig, *Committee Hansard*, 20 April 2017, p. 42.

36 CSIRO, *Submission 33*, p. 5. The committee was also advised that the tagging programs allow for genetic samples to be taken for analysis, which provides information useful for estimating population trends and the trend over time. Professor Nic Bax, Senior Principal Research Scientist, CSIRO, *Committee Hansard*, 20 October 2017, p. 7.

37 Mr Troy Pickard, Mayor, City of Joondalup, *Committee Hansard*, 20 April 2017, pp. 31–32.

38 During the committee's Brisbane hearing, Dorsal provided detailed evidence about the sources of the information relied on for the Dorsal app, including how public reports are filtered to ensure the reports are relevant, timely and sufficiently detailed. See Mr Allan Bennetto, Dorsal, *Committee Hansard*, 31 July 2017, pp. 42–43.

continued scientific tagging of sharks and sharing of data with the public so they can have informed decisions before going in the water.³⁹

6.33 Associate Professor McPhee, who described tagging programs as 'an important part of mitigation', noted that such programs are a 'long-term approach' as the efficacy of these efforts 'is enhanced when the number of animals tagged is large, and the number and location of receivers to detect tagged sharks are optimised'.⁴⁰

6.34 Others, however, questioned the overall benefits of tagging programs for public safety. Australian Aerial Patrol submitted that:

Tagging programs may provide some useful data on shark movements but their utility for protecting bathers is unproven and not evaluated by independent scientists. Tagging rates are low and the number of listening stations is unlikely to be of any relevance to bathers. The cost of a bather protection program would be astronomical and beachgoers deserve the full facts on what tagging programs can actually deliver.⁴¹

6.35 Dr Blount from Cardno noted that a practical limitation to shark tagging programs is that, for them to be effective, every dangerous shark or a large proportion of them would need to be tagged.⁴² Dr Blount also noted there are a limited number of listening stations to detect acoustic tags. He considered this might not be clear to members of the public who rely on websites that use this information about detected sharks. He explained:

I have looked at the SharkSmart app and where I live at Long Reef and where I surf there is no listening station. The nearest one, I think, is Bondi. So it kind of gives a false sense of security. If you do not really understand how the system works you look at your app and think, 'Well, there's no shark been spotted in my area for a long time,' but that is because there is no system in place to actually tell you if there is a shark there or not.⁴³

6.36 Mr Duncan Leadbitter, Director, Australian Aerial Patrol, made a similar observation:

If you look at the tagging work, the general public would think that all sharks have tags and there is a little beeper that goes off when a shark comes close to the beach. In reality, very few sharks are tagged. There are very few listening stations, and for the ones which are satellite tags, they

39 Dr Christopher Neff, *Submission 48*, p. 5.

40 Associate Professor Daryl McPhee, *Submission 58*, p. 3.

41 Australian Aerial Patrol, *Submission 6*, p. 3. See also page 22 of the submission.

42 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 13.

43 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 12.

only work when the shark is on the surface. So these sorts of programs are quite misleading from a beach safety viewpoint.⁴⁴

6.37 Mr John Heaton noted that a further limitation of the tracking apps is that surfers will not be using them when surfing. He stated:

There is not much point in having that SharkSmart app on your phone, when it is in your trouser pocket locked in your car and you are out surfing, and the listening station goes off. It is useless.⁴⁵

6.38 Mr Bennetto from Dorsal advised that, in response to this issue, it unsuccessfully sought funding from the DPI to develop a wearable device that provides users with real-time alerts. Mr Bennetto added that 'technology still needs to play a little bit of catch-up for that to be seamless'.⁴⁶

6.39 Individuals may also not want to access information about shark sightings before they enter the water. For example, when asked whether he used the New South Wales Government's Sharksmart program, Mr Daniel Webber responded:

No, I do not, and I do not want to know about it. I avoid people on the way to the surf so I do not have sharks on my mind. It is not fun thinking about sharks, and you try to keep busy. The worst thing that happens is when the surf backs off, you are dangling for 20 minutes and you start to think about it. Usually for me that is a downward spiral and within half an hour I get out.⁴⁷

6.40 Whether the existence of multiple shark alert platforms, including those operated by state governments, surf lifesaving organisations and Dorsal, is an ideal arrangement was discussed. Mr Bennetto from Dorsal explained that Dorsal was established after a spike in shark encounters and when he realised a national register for surfers and other water users to check before entering the water did not exist. In developing the Dorsal app, Mr Bennetto advised that Dorsal contacted state fisheries departments and the state and national surf lifesaving bodies in an attempt to collaborate with those organisations, yet most of those efforts 'fell on deaf ears and we just went about doing it ourselves'. Mr Bennetto remains of the view, however, that a national platform to collate and disseminate shark information would be preferable to the current arrangement. Mr Bennetto stated:

We have fallen into that platform by default, because there is nothing available. But I think there is room for improvement with a much more coordinated national approach and services. We need more stakeholders

44 Mr Duncan Leadbitter, Australian Aerial Patrol, *Committee Hansard*, 17 March 2017, p. 20.

45 Mr John Heaton, *Committee Hansard*, 2 May 2017, p. 9.

46 Mr Allan Bennetto, Dorsal, *Committee Hansard*, 31 July 2017, pp. 44, 57.

47 Mr Daniel Webber, *Committee Hansard*, 17 March 2017, p. 29. Mr Dale Carr also described individuals using apps for a period that, after time, tired of reviewing the information and decided to use them no longer. See *Committee Hansard*, 2 May 2017, p. 16.

from government, researchers, local communities and ultimately the water user.⁴⁸

6.41 Animal welfare concerns were also expressed regarding the tags. Mr Fred Pawle submitted that 'there are reasons to believe that tags are not benign to sharks'. He explained:

Most tags these days are surgically inserted. They emit regular beeps and are powered by batteries. Many satellite tags, which can be picked up anywhere on earth the shark breaches the ocean's surface, have suspiciously disappeared soon after they have been attached. Researchers are strangely incurious about the possibly malign effects they inflict. They are supposed to be recording "natural" behaviour, yet there are reasons to imagine they are significantly altering the behaviour of both the sharks and their prey.⁴⁹

6.42 Dr Peter Kerkenezov, who discussed this issue extensively in his submission, argued that:

It is...highly probable the demeanour of most captured sharks, inserted with a 69 kHz abdominal V16 acoustic tag transmitting at 150–162 dB power output, is altered for the rest of its pitifully shortened life span.⁵⁰

6.43 Associate Professor McPhee, however, submitted that animal welfare issues associated with tagging 'can be dealt with through existing Animal Ethics protocols'.⁵¹

6.44 Finally, Professor Meeuwig expressed concern that, by tagging sharks, researchers could potentially be endangering them by providing a means by which the sharks could be tracked down and killed.⁵² When questioned about this risk, Professor Nic Bax, CSIRO, acknowledged that as many tagging devices belong to state governments potentially the information could be used for this purpose. However, Professor Bax stressed that as only a small proportion of the shark population is tagged 'the likelihood that a tagged shark would be involved in one of those attacks is, correspondingly, relatively small'.⁵³

48 Mr Allan Bennetto, Dorsal, *Committee Hansard*, 31 July 2017, p. 42.

49 Mr Fred Pawle, *Submission 56*, p. 2.

50 Dr Peter Kerkenezov, *Submission 8*, pp. 4–5. See also Mr Kim Allen, *Submission 47*.

51 Associate Professor Daryl McPhee, *Submission 58*, p. 3.

52 Professor Jessica Meeuwig, *Committee Hansard*, 20 April 2017, p. 43.

53 Professor Nic Bax, CSIRO, *Committee Hansard*, 20 October 2017, p. 8.

Sonar technology

6.45 In the section on aerial surveillance earlier in this chapter, multispectral and hyperspectral imagery was discussed as a form of detection technology that may assist to overcome the difficulties associated with identifying sharks in the water visually. A further category of detection technology being developed for this purpose relies on sonar.

6.46 A product under development that uses sonar technology is Clever Buoy, which is a device being commercialised by Shark Mitigation Systems with funding from Google and investment from Optus.⁵⁴ Clever Buoy uses 'sonar technology coupled with tailored software to detect shark sized objects'.⁵⁵ Both the New South Wales DPI and the Western Australian Department of Fisheries have recently conducted in-water trials of the technology.⁵⁶

6.47 Mr Richard Talmage, who is the general manager of the business developing Clever Buoy, explained that the technology does not utilise any deterrent measures; rather, it is an early warning detection system that facilitates information about sharks being disseminated to beach patrols and the public. Mr Talmage stated:

Conceptually it works as a virtual shark net. We installed a number of sonar transducers and on the seafloor to create a virtual shark net, which is non-invasive to marine life. It lets them come and go as they please and provides an early warning system to beach authorities. It differentiates based on the size and shape and swim pattern of the object between different species. If it is determined to be highly likely to be a shark, that information is passed on to the beach authorities.⁵⁷

6.48 On how the information about sharks can be disseminated to assist beach safety efforts, Mr Talmage explained that, for metropolitan beaches with volunteer or professional lifesaving services, the information can be communicated directly to them. As with information about tagged sharks, the sharks detected by Clever Buoy can also be made public via existing public warning systems, such as the Western Australian Government's Sharksmart program, which publishes information about

54 Mr Richard Talmage, General Manager, Shark Mitigation Systems, *Committee Hansard*, 17 March 2017, p. 44.

55 DPI, 'Shark management', www.dpi.nsw.gov.au/fishing/sharks/management (accessed 5 December 2016).

56 DPI, 'Shark management'; The Hon Joe Francis MLA, Western Australian Minister for Fisheries, and the Hon Bill Marmion MLA, Minister for Innovation, 'Trial of new shark detection technology', *Media release*, 26 November 2016, www.mediastatements.wa.gov.au/Pages/Barnett/2016/11/Trial-of-new-shark-detection-technology.aspx (accessed 5 December 2016).

57 Mr Richard Talmage, Shark Mitigation Systems, *Committee Hansard*, 17 March 2017, p. 41.

sharks detected to the general public via social media. For beaches in remote areas, Mr Talmage noted that the information could be provided to the police or a ranger.⁵⁸

6.49 Mr Talmage used the recent trial at City Beach, Perth to provide an overview of how the technology detects and reports sharks in practice:

Once an object enters the sonar's field of view, the software looks at that object's size, shape and swim pattern and determines whether there is a high probability that it is a shark. That happens within a few seconds. It continues to track and monitor that object while it is in the field of view of the sonar. As soon as we have detected an object that has a high probability of being a shark our system does two things...An alert goes straight through to the fisheries interface and that automatically goes out through their smart shark network. An alert also goes directly into a closed mobile application, so a lifeguard sitting on a beach or Surf Life Saving Western Australia's head office in Balcatta both get a notification through a mobile app...The mobile application will give them the size of the object and the date and time that it was detected; so, within a few seconds, they have got that information. We will also then geolocate the location of that object on a map. Similar to a Google map view, they will get a pin on a map saying this is where the object is. It will also show them the direction that object is heading in—for example, if it is heading parallel to the beach, into the beach or out to sea.⁵⁹

6.50 Dr Neff expressed concern that the limitations of products such as sonar technology are not understood by the public. He argued that this technology 'can be heavily influenced by ocean conditions, swell, and may only be effective at low-energy beaches similar to Sydney Harbour'.⁶⁰

6.51 It was emphasised, however, that the technology is at a trial stage. Mr Talmage explained that the City Beach trial had the following three key objectives: to undertake an environmental factor assessment; to enable the government to assess the stability and robustness of the technology; and to assess the practical application of the technology, including by working with the Department of Fisheries and Surf Life Saving Western Australia.⁶¹

6.52 Some submitters that follow the development of emerging technologies provided favourable comments about Clever Buoy. For example, the Australian Marine Conservation Society submitted:

Clever Buoy is a rapid prototype, proof of concept R&D project that aims to develop shark detection technology. They are smart ocean buoys that

58 Mr Richard Talmage, Shark Mitigation Systems, *Committee Hansard*, 17 March 2017, p. 41.

59 Mr Richard Talmage, Shark Mitigation Systems, *Committee Hansard*, 17 March 2017, p. 43.

60 Dr Christopher Neff, *Submission 48*, p. 5.

61 Mr Richard Talmage, Shark Mitigation Systems, *Committee Hansard*, 17 March 2017, pp. 41–42.

detect large swimming objects, like sharks, and send real-time valuable information to lifeguards on the beach. This technology has potential to improve detection and communication in real time, particularly at peak periods when large numbers of visitors visit the coast.⁶²

6.53 As a category of emerging technology generally, AIMS submitted that systems intended to detect sharks could potentially be effective for metropolitan beach environments. AIMS commented that if systems designed to detect the presence of potentially dangerous sharks are coupled with a cost-effective early warning system, this could 'shape up as the most effective approach for minimizing human–shark interactions in these areas'.⁶³

6.54 The current expense associated with systems such as Clever Buoy was noted, however. Dr Blount explained:

Clever Buoy has a lot of potential, but it is very focused on a small area. Once you try and cover a whole beach or larger scale it is an incremental unit cost of the unit to have them. Say, for Bondi they may need 10 units...it will be a lot of money. It will be in the hundreds of thousands or the millions. That is just one beach. In terms of cost-effectiveness that is something that has to be considered.⁶⁴

6.55 Mr Talmage countered that, as the system is a 'very new technology at the moment' that is 'evolving rapidly with more research and development', the costs are high at present but are expected to decrease over time. In particular, Mr Talmage emphasised that the system is being procured in small numbers (one to three units) at a high unit cost; if (or when) higher volumes are procured, there would be 'a significant reduction in unit cost'. Mr Talmage further argued that the cost of installing one Clever Buoy unit, which would provide coverage for approximately 400 metres, is comparable to the cost associated with installing and maintaining a shark net particularly once the lower operational costs of the Clever Buoy are taken into account.⁶⁵

Beach enclosures and eco-barriers

6.56 As discussed in Chapters 3 and 4, shark nets cover a specific space but do not provide a barrier between swimmers and surfers and potentially dangerous sharks—they essentially are a passive fishing activity that removes sharks. However, the committee received evidence regarding beach enclosures that provide a physical barrier, including 'eco-friendly' barriers.

62 Australian Marine Conservation Society (AMCS), *Submission 38*, p. 6.

63 Australian Institute of Marine Science, *Submission 49*, p. 5.

64 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 14.

65 Mr Richard Talmage, Shark Mitigation Systems, *Committee Hansard*, 17 March 2017, pp. 42–43.

6.57 Generally, eco barriers are 'made from nylon, with a clip-together interlocking mechanism hung between a nylon float line on the water surface and an anchored line along the seabed'.⁶⁶ Global Marine Enclosures, which is a developer of beach enclosures, explained that these products are intended to restrict large predators from entering the enclosed area while 'allowing smaller species such as fish to pass freely inside'. The nylon material prevents marine life from becoming entangled with the barrier; Global Marine Enclosures advised that there 'has never been any bycatch or entanglement in our beach enclosures'.⁶⁷

6.58 Another business involved in eco barriers, Sharksafe Barrier, explained that its product:

...successfully bio-mimics the visual effects of a kelp forest and combines this with a series of permanent magnetic (i.e. barium-ferrite magnets) stimuli to form a visual and magnetic barrier that dissuades sharks from passing through. It does not negatively affect any other marine life such as seals or bony fishes that naturally utilize the kelp forest as effective refuge areas.⁶⁸

6.59 The key advantage of effective enclosures and barriers is that, for areas of the coastline where they are suitable, they can provide bathers with 100 per cent protection from sharks.⁶⁹ Global Marine Enclosures emphasised that, not only are its products effective in suitable conditions at keeping sharks away from beach users, they 'give ocean users confidence and peace-of-mind as they provide a physical barrier that can be seen'. Global Marine Enclosures continued:

The point here is that a measure that increases actual safety without increasing perceived safety will lead to a suboptimal outcome as people will not enjoy the benefits of the ocean environment. The two must be achieved together, which is a key advantage that physical structures (beach enclosures) have over electrical, sonar, light pulse, and other experimental measures.⁷⁰

6.60 Global Marine Enclosures argued that this benefit is proven by evidence that beach enclosures 'attract more people to the beach, including locals, visitors and tourists, who previously were not using the beach', with consequential benefits for

66 Australia for Dolphins, *Submission 4*, p. 4. See also Global Marine Enclosures, *Submission 31*, p. 3.

67 Global Marine Enclosures, *Submission 31*, pp. 3, 4. For further details about the design and deployment of eco barriers, see Mr Troy Pickard, Mayor, City of Joondalup, *Committee Hansard*, 20 April 2017, p. 31.

68 Sharksafe Barrier explained that mimicking the kelp forest exploits the 'natural instinct of sharks of avoiding to enter thick kelp forests'. It also argued that the 'addition of the magnetic fields adds an extra safety measure, since large magnets proved to be a strong deterrent for shark species...' Sharksafe Barrier, *Submission 29*, pp. 3–4.

69 Professor Shaun Collin, *Committee Hansard*, 20 April 2017, p. 39.

70 Global Marine Enclosures, *Submission 31*, p. 3.

businesses associated with coastal tourism. Global Marine Enclosures acknowledged that the extent of these economic benefits is unknown and suggested that further research on this matters would be valuable.⁷¹

6.61 Eco barriers attracted support from environmental groups provided that the design of the barriers does not negatively affect marine life.⁷²

6.62 Shark barriers are used successfully at Coogee Beach and Sorrento Beach in Western Australia.⁷³ The Mayor of the City of Joondalup, which includes Sorrento Beach, described the barrier there as being 'a significant success'. He explained:

We have seen a dramatic increase in the number of people using Sorrento Beach as a safe swimming destination. They are not only from our community; there are a significant number of people coming from outside the city of Joondalup. Sorrento Beach is a very popular beach anyway, but we now have an asset in our city that is attracting visitations from other local governments across the metropolitan area. The northern corridor of Perth has a high proportion of immigrants—40 per cent of our community were born overseas—and many of them are not competent and comfortable in the ocean, so it provides them with peace of mind. Not only is there a surf club with an appropriate lifeguard on duty, but indeed there is now a beach enclosure.⁷⁴

6.63 The New South Wales Government attempted trials of eco-friendly shark barriers at two beaches on the north coast. The Ballina Lighthouse & Lismore Surf Life Saving Club explained that the community supported the barrier as it was intended to provide whole of beach protection.⁷⁵ However, as the manufacturers 'were unable to safely and effectively install the barriers', the trials were discontinued in 2016.⁷⁶

6.64 Dr Blount from Cardno commented on why conditions at the beaches chosen for the New South Wales trial were unsuitable for eco barriers, and indeed why many New South Wales beaches may be unsuitable. He explained:

One of the special things about New South Wales is that it is a high-energy environment. There is quite a lot of swell. A greater than three-metre sized swell is pretty common, and you really need to have something that is capable of staying out there for a long time. You just have to look at the

71 Global Marine Enclosures, *Submission 31*, p. 5.

72 AMCS, *Submission 38*, p. 6; HSI, *Submission 43*, p. 22; Greenpeace Australia Pacific, *Submission 50*, p. 16.

73 Australia for Dolphins, *Submission 4*, p. 4.

74 Mr Troy Pickard, Mayor, City of Joondalup, *Committee Hansard*, 20 April 2017, p. 31.

75 Ballina Lighthouse & Lismore SLSC, *Submission 52*, p. 2.

76 DPI, 'Shark management', www.dpi.nsw.gov.au/fishing/sharks/management (accessed 5 December 2016).

Pasha Bulker—ships actually wash up on the shore in New South Wales, so it is important that these things have durability.⁷⁷

6.65 On the failed New South Wales north coast trial, Australian Seabird Rescue commented:

Eco Shark Barriers were placed in areas that were not suitable as a trial at Lighthouse Beach in Ballina and Seven Mile Beach in Lennox Head. The barrier that was attempted to be installed at Seven Mile Beach at Lennox Head was far from an eco barrier. [Australian Seabird Rescue] received many pieces of nylon rope and plastic ties and buoys that had come loose from the barrier that were delivered to us from members of the public, that had been found on the beach. This created a hazard for marine wildlife and was an eyesore.⁷⁸

6.66 Australian Seabird Rescue explained that it would welcome a new trial in areas 'not so affected by currents, waves and sand movements'.⁷⁹

6.67 Some submitters were optimistic that the challenges associated with placing eco-barriers at high-energy beaches, including surf beaches, could be overcome. HSI submitted:

A beach enclosure design funded by the French Government has been trialled at surf beaches on Reunion Island, with mixed results. Our first surf beach trial at Lennox Head in August 2016 proved unsuccessful due to installation challenges and dynamic sand movements affecting the barrier near the seabed. These issues were addressed in the design and installation methodology of the successful Quinns Beach project. The upgrades have been significant and we believe a second surf beach trial is warranted.⁸⁰

6.68 In addition to the current challenges associated with successfully using eco barriers at high-energy beaches, a view among several submitters is that while eco barriers may be a suitable solution for bathers, there may have continued limitations for surfers due to the nature of the surfing activity. For example, Dr Blount told the committee:

It is very difficult, in terms of the systems I have looked at, to come up with something that will protect surfers. A lot of them surf around headlands, not along the beaches themselves. There are all sorts of challenges with getting a system to operate around headlands as well as the beaches.⁸¹

77 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 11.

78 Australian Seabird Rescue, *Submission 37*, p. 3. Mr Fred Pawle also commented on the hazards created by the failed trial: see *Submission 56*, p. 4.

79 Australian Seabird Rescue, *Submission 37*, p. 3.

80 Global Marine Enclosures, *Submission 31*, pp. 3–4.

81 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 16. Dr Christopher Neff also recommended that eco barriers be used in low-energy areas, such as the beaches in Sydney Harbour. See *Submission 48*, p. 5.

6.69 Associate Professor McPhee added that surfers 'do not necessarily want them—and for very good reason; they interrupt surfers'.⁸²

6.70 The Queensland Department of Agriculture and Fisheries noted that other uncertainties of eco barriers at present 'include the ability to withstand multiple years of deployment and the potential escalating costs of cleaning of bio-fouling from marine growth'.⁸³ Dr Blount added that the barrier systems can be expensive, costing up to \$1 million to install 'for one small beach or a part of a beach'.⁸⁴

6.71 Nevertheless, there was significant support for eco barriers to be maintained or trialled at suitable locations, and for continued research to improve the technology. For example, HSI submitted:

We suggest that further research be conducted to explore the effectiveness of eco-barriers in locations across Australia. Eco-barriers have proven to be effective for WA beaches. Northern QLD could be a suitable location for these barriers, due to the nature of wave action and a lack of surfing beaches. In particular, Eco-barriers would be an ideal replacement for nets and drumlines within the GBRMP, and use of these should be explored in locations that would be suitable in NSW and Southern QLD instead of lethal methods.⁸⁵

6.72 Dr Sharon Burden also expressed support for measures such as eco barriers that isolate children from sharks and do not create other risks, such as entanglement.⁸⁶

Personal and 'whole of beach' deterrent and protection products

6.73 There is a wide range of personal deterrents utilising emerging shark deterrent and detection technologies. These deterrents and other protection devices that are currently available or under development include chemicals intended to repel sharks, camouflage wetsuits and surfboards intended to disrupt shark vision, a protective Kevlar wetsuit, and electric deterrents and magnets.⁸⁷ Although other deterrent products were drawn to the committee's attention and their efficacy discussed,⁸⁸

82 Associate Professor Daryl McPhee, *Committee Hansard*, 2 May 2017, pp. 38–39.

83 Queensland Department of Agriculture and Fisheries, *Submission 32*, p. 6.

84 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 11.

85 HSI, *Submission 43*, p. 23.

86 Dr Sharon Burden, *Committee Hansard*, 28 July 2017, p. 23.

87 See Cardno, *Shark deterrents and detectors: review of bather protection technologies: Report prepared for the NSW Department of Primary Industries*, October 2015, www.dpi.nsw.gov.au/data/assets/pdf_file/0020/621407/cardno-review-of-bather-protection-technologies.pdf (accessed 5 December 2017), pp. 3–4, 17; Cr David Wright OAM, Mayor, Ballina Shire Council, *Committee Hansard*, 2 May 2017, p. 20.

88 For example, see Associate Professor Daryl McPhee, *Submission 58*, pp. 3–4.

electric deterrent products such as Shark Shield and RPELA were the subject of detailed examination during this inquiry.

Overview of products

6.74 Shark Shield is a range of personal electrical deterrents developed by a Western Australian company of the same name. Shark Shield takes advantage of small, short-range electrical receptors in shark snouts which are used for finding food. The electromagnetic field generated by Shark Shield is intended to cause 'unbearable spasms in these sensitive sensors which turn sharks away'.⁸⁹ At the committee's first Perth public hearing, Mr Lindsay Lyon, Managing Director, Shark Shield, provided further details about the technology utilised by Shark Shield. Mr Lyon stated:

The way this works is that sharks have little gel-filled sacs they use to find food at close range, in the same way you and I use touch; they have to be that close. That is as well as sight, sound and all those things that they have. What this does is to create a very powerful electric field, so these little gel-filled sacs that they have, which are expecting to feel electrical field from a heartbeat or that kind of thing, get near this powerful electric field—if you could see it, it is about six metres by three metres and looks like a football—and it causes them to spasm and turns them away.⁹⁰

6.75 After Mr Lyon advised that the technology uses a direct current of 100 volts, he explained:

Even though that sounds like a lot, it is actually not a lot because you are in the water and you have a big body of water to spread that over. If you touch it, it gives you a shock. Think of it as more than a static electricity shock but significantly less than an electric fence shock. Interestingly, a lot of people reach around and grab it to know it is working. It gives them confidence. In fact—I now use this on my board all the time—every now and again, if I cannot feel it, I reach around to touch it and go: 'Yeah, it's working. It's okay.' It is sort of like a 'Listerine burns my mouth, so it must be good for me' kind of thing.⁹¹

6.76 Evidence was also received about another shark deterrent product for surfboards known as RPELA. Mr David Smith, who manages the company that develops RPELA, advised that the product is cost-effective and has the additional benefits of not affecting 'the way the board performs, and the surfers do not get affected by its electromagnetic field'.⁹² The committee was advised that RPELA

89 Shark Shield, 'Shark Shield Ocean Guardian', tabled 20 April 2017, p. 6.

90 Mr Lindsay Lyon, Managing Director, Shark Shield, *Committee Hansard*, 20 April 2017, p. 19. See also *Committee Hansard*, 28 July 2017, p. 57.

91 Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 20 April 2017, p. 19.

92 Mr David Smith, Chief Executive Officer, SurfSAFE, *Committee Hansard*, 20 April 2017, p. 25.

would be subject to independent testing, with trials to be conducted in August or September 2017.⁹³

6.77 Shark Shield attracted support from Associate Professor McPhee, who described it as a product that has been 'independently and scientifically tested' and which has been 'shown to significantly reduce the risk of a bite, but not eliminate it entirely'.⁹⁴ The associate professor explained that:

In controlled experiments, when the Shark Shield was switched off—so when the sealed decoy was switched off; and this was in a high white shark area adjacent to a seal colony in South Africa, from memory—there was a 90 per cent chance of a bite. When it was switched on there was a 16 per cent chance of a bite. So scientifically there is a statistically significant reduction in risk from a Shark Shield. Is it zero? No. But the manufacturers, from my understanding, have never said it is zero, but there is a statistically significant reduction in risk—down from 90 per cent to 16 per cent. It is going to be a long time before anything improves on that.⁹⁵

6.78 Associate Professor McPhee commented that:

There may be other electric individual deterrents that can also be shown to be effective, but they have not been subjected to independent and rigorously designed testing to demonstrate that this is the case.⁹⁶

6.79 As noted above, research has concluded that, in a test where sharks were allowed access to bait for a 10-minute period, the use of Shark Shield reduced the probability of a shark bite from 90 per cent to 16 per cent. That personal deterrents such as Shark Shield are not 100 per cent effective, however, was commented on by several witnesses. Dr Blount from Cardno observed that the product 'changes the behaviour of sharks so it reduces the potential for a shark to come closer to a person more than if you did not have one on'. He added that the user might still be attacked if they are wearing a Shark Shield 'but there is less chance of that happening'.⁹⁷ Dr Christopher Neff similarly noted that electronic shark deterrents do not provide

93 Mr David Smith, Surf Safe, *Committee Hansard*, 28 July 2017, p. 66.

94 Associate Professor Daryl McPhee, *Submission 58*, pp. 3–4.

95 Associate Professor Daryl McPhee, *Committee Hansard*, 2 May 2017, p. 36. For more details about the experiments, see Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 20 April 2017, p. 18; and Professor Shaun Collin, *Committee Hansard*, 20 April 2017, pp. 37–38. Professor Collin noted that his testing relates to the product used by divers (with a two metre antenna), not the product used with surfboards. The research which concluded that the probability of a shark bite was 90 per cent when the device was in power-off mode and 16 per cent when in power-on mode involved a test where sharks were allowed access to bait for a 10-minute period and the first version of the Shark Shield devices (known as SharkPOD). See Shark Shield, *Submission 1*, p. 7.

96 Associate Professor Daryl McPhee, *Submission 58*, pp. 3–4.

97 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 12.

guaranteed protection against shark bites, and stated that 'research suggests that much depends on the motives of the shark'.⁹⁸

6.80 It was also acknowledged that, at present, certain personal electrical deterrents are not appropriate for children. With respect to the Shark Shield product, Mr Lyon advised:

You cannot apply it to very small boards, so it actually does not work for young children and teenagers. The smaller the board the more the electrical field is likely to come around the board and interfere with the user's experience.⁹⁹

6.81 However, evidence was received indicating that other products, such as RPELA, might be more suitable for children.¹⁰⁰

6.82 Dr Blount also noted that personal deterrents do not provide 'whole-of-beach' scale protection.¹⁰¹ Following the committee's April hearings, however, Shark Shield announced a pre-production release of a long-range version of its technology that could repel sharks up to a range of 100 metres away. It is intended that the technology, known as Ocean Guardian, will be subject to independent scientific testing.¹⁰²

6.83 The committee is also aware of a shark repellent cable developed in South Africa by the KwaZulu Natal Sharks Board. At present, a 100 metre cable that emits a low frequency pulsed electronic signal is being tested in Cape Town.¹⁰³ Media reports in August 2017, however, suggest that the Western Australian Government has been in discussions with the KwaZulu Natal Sharks Board regarding a trial of the cable at Cottesloe Beach.¹⁰⁴

98 Dr Christopher Neff, *Submission 48*, p. 5.

99 Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 20 April 2017, p. 21.

100 See Mr David Smith, SurfSAFE, *Committee Hansard*, 20 April 2017, pp. 25, 27.

101 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 12.

102 Shark Shield, 'Shark Shield announces breakthrough long range shark deterrent & capital raising', *Media release*, 1 May 2017. See also Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 20 April 2017, pp. 21–22; *Committee Hansard*, 28 July 2017, p. 57.

103 KwaZulu Natal Sharks Board, 'Shark repellent cable', www.shark.co.za/Pages/SharkRepellentTechnology (accessed 9 November 2017).

104 R Ardon, 'Cottesloe set to get world-first electromagnetic shark cable', *The West Australian*, 18 August 2017, <https://thewest.com.au/news/sharks/cottesloe-set-to-get-world-first-electromagnetic-shark-cable-ng-b88571488z> (accessed 9 November 2017).

Role of government in relation to emerging commercial products

6.84 Electrical shark deterrents have attracted the attention of state governments. For example:

- the New South Wales DPI is monitoring emerging technology such as 'the development of electronic shark deterrents...to determine their effectiveness and suitability';¹⁰⁵ and
- as noted in Chapter 3, the Western Australian Government is trialling a program where rebates of \$200 are available for independently verified devices purchased by surfers and divers. By September 2017, approximately 630 individuals had accessed the rebate.¹⁰⁶

6.85 Several submitters and witnesses reflected upon what should be the role of government in relation to personal deterrents developed by the private sector. Some submitters argued that governments should invest in these personal products rather than spending money on lethal measures. For example, Australia for Dolphins is of the view that:

...the government should be investing in emerging shark mitigation and deterrent measures...rather than continuing with out-dated techniques such as shark meshing and drumlines.¹⁰⁷

6.86 Ms Claudette Rechterik, Manager, SEA LIFE Trust Australia/New Zealand, noted that surfers, divers and snorkelers are at a higher risk of encountering a shark. Accordingly, Ms Rechterik argued that the \$16 million associated with the New South Wales shark management strategy instead could be used to subsidise electrical deterrents for these individuals.¹⁰⁸ Ms Belinda Atkins, Manager, Projects and Programs, Sydney Coastal Councils Group, suggested that government subsidies could be directed to a hire program for personal deterrent devices, which would be available to individuals undertaking activities that may expose them to a greater risk of encountering a shark than other ocean users, such as surfers.¹⁰⁹

105 DPI, 'Shark management', www.dpi.nsw.gov.au/fishing/sharks/management (accessed 5 December 2016).

106 The Hon Dave Kelly MLA, Western Australian Minister for Fisheries, 'Shark deterrents prove popular with community', *Media release*, 21 September 2017.

107 Australia for Dolphins, *Submission 4*, p. 4.

108 Ms Claudette Rechterik, Manager, SEA LIFE Trust Australia/New Zealand, *Committee Hansard*, 17 March 2017, p. 10.

109 Ms Belinda Atkins, Manager, Projects and Programs, Sydney Coastal Councils Group, *Committee Hansard*, 16 March 2017, p. 4.

6.87 It was argued that there is a need to consider how to encourage greater uptake of independently tested personal deterrents,¹¹⁰ such as promoting such devices in public safety campaigns.¹¹¹ Related to this, submitters and witnesses suggested that there is a role for government in assisting consumers to understand which products may be effective and to encourage individuals to use them. Dr Blount from Cardno, who advocated for this approach, argued it is particularly important for individuals 'in remote areas away from unpatrolled beaches where there is very little protection for bathers and surfers...to make good use of the personal protection devices in areas that the government cannot really cover through its existing programs'.¹¹²

6.88 Associate Professor McPhee (and others), emphasised that it is not the role of a government to endorse or promote particular products. Notwithstanding this, Associate Professor McPhee argued that governments do have a role in ensuring that 'consumers are fully informed on products designed to enhance human safety'. He added:

Fully informing consumers should include identifying that a product has been independently tested by scientists, the type of shark species that it has been tested on, the spatial area over which a product is likely to be effective, and any other factors that may substantially influence effectiveness in a given circumstance (e.g. murky water).¹¹³

6.89 Noting that there is currently 'intense commercial activity in individual deterrents', Associate Professor McPhee emphasised that credible independent scientific testing is necessary for consumers to identify which products are reliable. The associate professor noted that in the market there are:

...a lot of false claims and a lack of full disclosure of limitations in a form that is easily accessible for consumers. Further, there appears to be a reluctance by some manufacturers to subject their products to independent scientific testing. If money can be spent on substantial marketing of products, money can be spent on scientific testing. There is much "Science by YouTube". At least one manufacturer actively filters and removes any criticism or hard questions from their social media profile.¹¹⁴

6.90 Both Shark Shield and the manufacturer of RPELA emphasised the need for products to be subject to scientific testing. Shark Shield suggested that shark deterrent products are entering the market without being supported by independent research, which undermines 'the consumers' confidence in the product category'. Mr Lyon stated that in the shark deterrent product category 'a consumer today has no idea whether

110 Dr Daniel Bucher and Professor Peter Harrison, *Submission 23*, p. 6.

111 HSI, *Submission 43*, p. 23.

112 Dr Craig Blount, Cardno, *Committee Hansard*, 17 March 2017, p. 13.

113 Associate Professor Daryl McPhee, *Submission 58*, p. 4.

114 Associate Professor Daryl McPhee, *Submission 58*, p. 4.

they are buying something that has or has not been peer reviewed or is complete and utter snake oil—and, honestly, some of them are'.¹¹⁵

6.91 Shark Shield suggested that an Australian Standard for shark deterrent products is required to assist consumers to make informed purchases.¹¹⁶ Shark Shield observed that other safety products designed to reduce risk, such as seat belts and bicycle helmets, are subject to regulated minimum standards.¹¹⁷ Mr Lyon remarked:

If you have an Australian standard for bike helmets you can go into a store and buy a bike helmet and have a degree of confidence that it will do what it is claimed to do.¹¹⁸

6.92 At a subsequent hearing, Mr Lyon hinted at difficulties in identifying where products such as Shark Shield 'would fit within Australian standards at this point in time'. As an alternative, Mr Lyon suggested a process could be developed by which manufactures would self-declare, by statutory declaration, whether their product meets certain government-endorsed criteria.¹¹⁹

6.93 AIMS noted, however, that it is difficult to test deterrent technology as 'humans cannot be used in tests, and simulating human interaction scenarios is complex'.¹²⁰ Associate Professor McPhee, who emphasised that the government has a role in ensuring that deterrent products are suitable for that purpose, commented that an Australian Standard 'would be tricky because of the diversity of approaches'.¹²¹

6.94 Professor Nic Bax, CSIRO, recognised that there appears to be uncertainty in the community about 'how some of the shark deterrent devices work, how well they work and in what situations they would work'. Professor Bax argued that 'Australian citizens would profit from having some clear advice which came from an authoritative body'. When considering what role CSIRO could have in supporting such a process, Professor Bax commented:

I think CSIRO is open to how that body would be constructed, and we would certainly, I believe, support it. It's not necessarily our role to run that body, but I imagine that CSIRO would be happy to discuss with the appropriate groups to see what our role would be. We would be quite open, I think, to what our role would be.¹²²

115 Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 20 April 2017, p. 22.

116 The makers of RPELA and Mr Rick Gerring, whose brother Ben was killed in a shark attack, supported this position. See *Committee Hansard*, 20 April 2017, pp. 29, 46.

117 Shark Shield, *Submission 1*, p. 4.

118 Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 20 April 2017, p. 22.

119 Mr Lindsay Lyon, Shark Shield, *Committee Hansard*, 28 July 2017, p. 58.

120 Australian Institute of Marine Science, *Submission 49*, p. 5.

121 Associate Professor Daryl McPhee, *Committee Hansard*, 2 May 2017, p. 39.

122 Professor Nic Bax, CSIRO, *Committee Hansard*, 20 October 2017, p. 2.

6.95 Professor Bax continued by providing the following evidence on the issues that need to be addressed to improve consumer confidence in the product category:

I think there are two issues...One is testing the devices to understand how they work. The other is reviewing what testing has occurred and whether the claims made by manufacturers actually are supported by the evidence they provide. I think our position has been: actually, it is very difficult to test these devices because, of course, fortunately shark attacks are quite rare. As I understand it...a lot of testing is done in South Africa, where they have a more clear aggregation of white sharks they can test against.

So I would say that the role of an Australian group in this would not be to test these different devices; it would be to review whether the testing has been appropriate and whether the manufacturers' claims are backed up by evidence.¹²³

6.96 Professor Bax suggested that a process for reviewing the scientific testing of deterrent devices could be a technical advisory group, reporting to a department or a minister, modelled on the stock assessment groups used by the Australian Fisheries Management Authority in fisheries management.¹²⁴

Consumer support for the product category

6.97 Finally, it is necessary to consider the degree to which consumers, and in particular frequent water users such as surfers, will use products such as electric personal deterrents.

6.98 Overall views on the potential of these products differ. For example, Dr Sharon Burden highlighted how these products support personal responsibility. Dr Burden commented that surfers who purchase a surfboard and wetsuit should also 'be able to budget for personal protective devices'. Dr Burden continued this line of argument by equating equated personal deterrents with protective equipment required for other activities that involve an aspect of danger:

If a surfer says, 'I can't afford it,' to me that is like when my son wanted to get his motorbike licence. I would never have allowed him to get on a motorbike without a helmet or the best boots I could put on my credit card for him. I even went so far as to get him one of those Kevlar jackets, even though I couldn't afford it. I said, 'I'm going to kit you out in everything. My expectation is that you will wear them. If I see you on that motorbike on your learner plates without them, there will be trouble.'¹²⁵

6.99 The cost associated with personal devices, however, may limit take-up by tourists, other occasional beachgoers and families with multiple surfers.¹²⁶

123 Professor Nic Bax, CSIRO, *Committee Hansard*, 20 October 2017, p. 2.

124 Professor Nic Bax, CSIRO, *Committee Hansard*, 20 October 2017, p. 2.

125 Dr Sharon Burden, *Committee Hansard*, 28 July 2017, p. 19.

126 Mr Tony Isaacson, DiveCareDare, *Committee Hansard*, 31 July 2017, p. 49.

6.100 Occasional minor electric shock is another issue that users of particular products currently on the market encounter; some will tolerate the shocks, although others may decide to discontinue using the product because of them. Mr Daniel Webber told the committee:

My experience...is I was really not confident in the initial experience of Shark Shield. I thought there was no way I am going to be able to surf and enjoy my surfing with these electric shocks. It seems bizarre, but after 10 or 12 surfs now I am actually used to it. It is because the benefit is that I am getting to surf plenty of waves and having fun. The disadvantage is getting zapped a couple of times—some of the shocks are quite nasty—but the benefits outweigh the disadvantages.¹²⁷

6.101 However, other evidence received by the committee also reveals a broader issue in that some surfers may not be interested in personal deterrents, regardless of their effectiveness. Mr Webber provided the following observation:

Oddly enough, among the hardcore surfers—and they are the ones that are surfing most regularly—almost none of them have it [Shark Shield]. There are definitely a lot of them in the area, but I think that they are mainly the surfers who are not surfing as frequently. I apply the 80-20 rule, which I think really does make a lot of sense: that 20 per cent of the surfers surf 80 per cent of the time. I am pretty sure that this group that I am familiar with—and we are mainly surfing at Lighthouse Beach—I do not think any of them have it. It is not like I have asked everyone. I see them after surfs and they do not have it attached to their board. I think the attitude among this crew is to simply take the risk and just get on with your life.¹²⁸

6.102 Furthermore, some submitters and witnesses were sceptical about the current state of the product category. For example, Dr Meynecke, who stated that he prefers education and community outreach strategies over personal shark deterrent products, commented that he is 'concerned about some of the companies that are clearly making money out of this but not necessarily in the interest of the individual or of the public'.¹²⁹

127 Mr Daniel Webber, *Committee Hansard*, 17 March 2017, p. 31.

128 Mr Daniel Webber, *Committee Hansard*, 17 March 2017, p. 32.

129 Dr Jan-Olaf Meynecke, *Committee Hansard*, 31 July 2017, p. 9.

