

ASSESSMENT OF
THE ATTITUDES OF BEACH AND
OCEAN USERS TO SHARK
MITIGATION FOLLOWING
SMART DRUMLINE
TRIALS IN NSW



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1 EXECUTIVE SUMMARY

Sharks have a permanent place in the Australian psyche as well as in our waters. In recent years some of the approaches to managing sharks have divided our communities along several lines. This study listened to beach and ocean user thinking about management of human-shark interactions, with a special focus on SMART drumlines, VR4G listening stations and the SharkSmart App. The aim was to provide insights and evidence of community sentiment that will help government, authorities and other organisations to develop and communicate shark-related policy. The researchers visited five NSW regions that had recently experienced trials of SMART drumlines and VR4G listening stations - Ulladulla-Narrawallee, Kiama-Shell Cove, Forster-Tuncurry, Coffs Harbour-Sawtell and Ballina-Broken Head.

This research collaboration was conducted and supported by The Department of Primary Industries (DPI) NSW Shark Management Strategy (SMS), Charles Sturt University, and the Institute for Land, Water and Society.

1.1 Main findings

The main findings across the trial sites are presented here. The research addressed three questions concerning attitudes and awareness.

What are attitudes to and awareness of SMART drumlines?

- Most communities do not perceive that they have a problem with sharks; association with an official 'shark trial' can create perception of a problem that does not exist
- SMART drumlines were perceived to be better than mesh nets because they catch more target sharks, release sharks and have less bycatch
- SMART drumlines were widely valued for tagging sharks and contributing to research
- Ballina aside, there was low awareness as a mitigation strategy
- Many feel SMART drumline bait attracts sharks, and should not be near swimmers

- Many wanted more information about SMART drumlines – Does the bait attract sharks? How much do sharks suffer on the hook, during tagging, and after release?
- Contractors need to be made accountable for respecting the sharks during handling.

What are attitudes to and awareness of the SharkSmart App and the VR4G listening station?

- There was high awareness of the SharkSmart App
- The SharkSmart App was most valued for providing help to beach safety authorities
- The SharkSmart App was generally not useful to surfers, mostly because they do not carry phones or app-receiving devices when out in the water
- Constant app notifications feeds fear of sharks – SharkSmart App perceived to need information to be more localisable
- The SharkSmart App should give specific information (eg 5 sharks detected or 1 shark 5 times? Size of shark?)
- VR4G aids beach management, but only protects against the few tagged sharks where the listening station is located
- V4RG needs an alert (sound/light) system for people in the water in the vicinity
- VR4G visible just off shore can reassure, cause fear, or create a false sense of security.

What are attitudes to and awareness of shark mitigation strategies generally?

- Real physical risk from sharks is statistically low, but reassurance is important
- Local authorities are often unsure about appropriate response to shark alerts
- Shark information most useful in the hands of local humans experienced in beach safety
- Shark detection alerts not seamlessly communicated to local beach safety responders
- Little is known about sharks - research is encouraged and supported
- Avoid harming sharks and other marine life – for any reason
- Technology will increasingly help reduce risk without causing harm to marine life
- Drones are preferred – cost efficient, locally responsive, non-invasive, time-specific

- Overall there is support for the SMS approach: Preference for mitigation strategies that avoid harming sharks and other marine life; Emphasis on developing technologies and testing emerging approaches; Commitment to improving understanding through research.

1.2 Background

In 2015 the NSW government announced a 5 year Shark Management Strategy (SMS) to 'increase protection for bathers from shark interactions while minimising harm to sharks or other animals'.

SMART drumlines have been trialled as part of the SMS both as a research and risk mitigation tool. As a research tool, SMART drumlines have been used extensively for the shark tagging program due to their efficacy in catching target sharks (White, Bull and Tiger Sharks) with minimal bycatch. Tagged sharks are tracked in real-time via a network of 21 VR4G listening stations located at beaches along the NSW coast to improve understanding of the movement and distribution of sharks. Community members can also choose to monitor the presence of tagged sharks at any of these locations, as alerts are publicly available via the SharkSMART App and Twitter feed @NSWSharkSmart. SMART drumlines have been used most extensively on the north coast of NSW, due to the frequency of recent shark bites in this area. Six-month trials of SMART drumlines were also conducted at four other coastal locations (Coffs Harbour, Forster, Kiama and Ulladulla) and concluded in early 2018.

Prior to the commencement of the trials, a range of communication and engagement activities were undertaken in each location including Council briefings, beach signage (appendix 2), social media communications and community drop-in stands (appendix 3). The drop-in stands allowed beachgoers and other members of the public to informally discuss the trials and share concerns.

Community attitudes play an important role in the acceptability and success of policy approaches. An important aspect of all the trials was to understand community attitudes towards the use of SMART drumlines in the context of other strategies for minimising human-shark interactions. This study was designed to focus exploration on local beach and ocean user attitudes to shark management at the sites where SMART drumlines have been trialled.

1.3 Method

The researchers ran focus group discussions with beach and ocean users at each of five trial sites. A total of 43 beach and ocean users participated, including surfers, ocean swimmers, lifesavers, kayakers, anglers, tourism/small business operators, divers and conservation/environment organisation members. This approach explored people's thinking and reasons for the attitudes they hold.

1.4 Conclusions and recommendations

People hope for vigilance in risk mitigation without creating undue fear. The project found support for shark management in NSW generally, but the discussions revealed themes deserving reflection.

Mitigation effort should be proportional to local risk

At all sites beach and ocean users said they are mindful to avoid conditions that might increase risk of an encounter with a shark. Many people say they are more cautious than they used to be. However at most sites the participants perceived the real risk of physical harm from sharks to still be low.

Risk mitigation efforts by authorities are expected, but communities expect shark risk mitigation efforts to be proportional to the local risk of harm from sharks. In Ballina where risk was considered to be higher, participants were very appreciative of DPI programs including the SMART drumlines, but some other sites wondered why they had been chosen for trials. They were sometimes concerned that becoming a SMART drumline trial site could have unintended negative consequences. The region's official 'trial' association with sharks, and/or the highly visible SMART drumlines 500 metres off shore, can create a fear of sharks where previously there was no problem. This can in turn cause people to irrationally avoid the water for recreation, and tourists to avoid the region altogether.

Investment in mitigation and trials needs to be developed to meet local needs, and well justified to local communities.

Some strategies are not well understood

The study found general support for the SMART drumlines and VR4G listening stations and the SharkSmart App, but not always for the reasons expected. At most (not all) sites SMART drumlines and VR4G listening stations were valued for contributions to research (which is highly valued by many ocean users), but not valued for making waters safer. SMART drumlines were widely perceived to attract sharks to waters where people swim, with many calling for them to be located further away from swimmers. The SharkSmart App is widely known to have given the community access to data about shark movements, but it was most valued as an aid for professionals with responsibility for beach safety. Individuals respond differently to what they see and hear. Some experience listening stations, SMART drumlines and drones as a reassuring presence, others perceive them to be a frightening reminder of sharks. That said, community attitudes can be influenced by information from sources (DPI and others) perceived to be credible.

Recommendations

The main shark management recommendations arising from the project emphasise the need to engage and contribute to localised solutions to shark management, justify and clarify the strategies implemented, and to support innovation and research:

- Focus on understanding locale, localising strategy with beach managers, providing locally useful shark information and alerts, and justifying strategies locally;
- Contribute to a process for improving integration, cooperation and communication between shark detectors and those with local responsibility for beach safety, eg draft governance structures and protocols with local authorities to guide the development of local management strategies;
- Communicate well and often with the public. Perceptions are important for policy success. In the absence of information, people will speculate and find their own information sources and stories. Explain, justify and promote success stories using a range of media;
- Address the perception that SMART drumlines attract sharks, or people may reject locating SMART drumlines anywhere near people;
- Address the dominant perception that SMART drumlines are just for research;
- Build community confidence in contractors handling and tagging sharks (consider a role for scientists and/or the DPI);
- Be transparent and offer evidence of efficacy of interventions (eg shark movements after SMART Drumline's release);
- Address uncertainty about outcomes for sharks that SMART drumlines catch. Rebut or justify claims of suffering before, during and after tagging;
- Clarify the purpose of VR4G listening stations and their role in the strategy;
- Address low awareness of the 'Favourite locations' settings on the SharkSmart app for localising shark alert information;
- Conduct research into understanding features of mitigation strategies that drive reassurance and fear;

- Continue investing in R&D for technologies that mitigate risk to humans, sharks and other marine life; There is optimism about technology playing an ever-increasing role in beach safety (eg drones with sirens); and
- Prioritise resourcing and communication for popular and patrolled areas of coast – or areas where there is scientific evidence of higher risk of human-shark interaction.

The final section of the report includes recommendations **in the event of future trials**, summarised here as:

- Select locations where trial interventions are well justified and clearly communicate justifications;
- Plan for controlled and uncontrolled communication; and
- If the trial proceeds, meet expectations of transparency and local service integration.

Conspicuous shark management can reassure, but it can also create fear. In the absence of recent or frequent serious incidents, most communities do not perceive they have a shark ‘problem’. Perhaps the most important reminder from this study has been that effective shark management, that is acceptable to local communities, requires understanding of the local context and involvement of those with local expertise and credibility.

2 BACKGROUND

A range of shark management strategies have been used historically in NSW (eg shark nets, shark culls, surveillance), and new technologies are emerging. However, there is, as yet, no 'best option' to mitigate unprovoked shark bites (Cardno 2015). For those responsible for shark management policy, the complexity of options is compounded by increased levels of human-to-human conflict around appropriate mitigation approaches. In particular, strategies that were once acceptable to the wider community (eg shark nets), have become increasingly controversial due to their impacts on targeted and non-targeted marine life.

In 2015, the NSW government announced the NSW Shark Management Strategy (SMS), a five-year program designed to complement the existing Shark Meshing (Bather Protection) Program. The main aim of the SMS is to 'increase protection for bathers from shark interactions while minimising harm to sharks or other animals'. The primary focus of the SMS has been on trialling and testing technologies that minimise impacts to sharks and other marine life, including SMART drumlines, drones and helicopter aerial surveillance, and listening stations to detect tagged sharks.

SMART drumlines (Shark-Management-Alert-in-Real-Time) have become an important element of the SMS. Unlike traditional drumlines which are designed or operated to catch and kill sharks, animals caught on SMART drumlines can be released alive. This is achieved through a satellite-linked communication unit on the drumline which alerts operators when an animal has taken the bait and is caught on the line; operators can then respond immediately to manage the animal

(<https://www.dpi.nsw.gov.au/fishing/sharks/management/smart-drumlines>).

SMART drumlines have been trialled as part of the SMS both as a research and risk mitigation tool. As a research tool, SMART drumlines have been used extensively for the shark tagging program due to their efficacy in catching target sharks (White, Bull and Tiger Sharks) with minimal bycatch. Tagged sharks are tracked in real-time via a network of 21 VR4G listening stations located at beaches along the NSW coast to improve understanding of the movement and distribution of sharks. Community members can also choose to

monitor the presence of tagged sharks at any of these locations, as alerts are publicly available via the SharkSMART App and Twitter

(<https://www.dpi.nsw.gov.au/fishing/sharks/sharksmart>). As a risk mitigation tool, SMART drumlines are used to intercept and catch target sharks near beaches and relocate sharks one kilometre offshore, thereby reducing the chances of interaction with ocean users. Tagging data has shown that captured sharks have a natural tendency to move offshore in the short to medium term, further mitigating risk.

To date, SMART drumlines have been used most extensively on the north coast of NSW, due to the frequency of recent shark bites in this area. This has included intermittent deployment for research purposes since December 2015; and two trials in which SMART drumlines were deployed at the same time as traditional shark nets to compare the efficacy of these methods as a management tool (December 2016 - May 2017 and November 2017 - May 2018). Six-month trials were also conducted at four other coastal locations (Coffs Harbour, Forster, Kiama and Ulladulla) and concluded in early 2018.

Prior to the commencement of the trials, a range of communication and engagement activities were undertaken in each trial location including Council briefings, beach signage, social media communications and community drop-in stands. The drop-in stands allowed beachgoers and other members of the public to informally discuss the trials and share concerns.

An important aspect of all trials was to understand community attitudes towards the use of SMART drumlines in the context of other strategies for minimising human-shark interactions. On the far north coast (Ballina/Evans Head), NSW DPI collected data via three community surveys conducted during the shark net/SMART drumlines trials. Surveys included representative phone interviews of 600 local residents and online questionnaires open to anyone from any geographic region who wanted to have a say. The results of these surveys (https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0009/829458/second-north-coast-shark-meshing-final-report.pdf) showed that most residents were 'somewhat' or 'strongly' supportive of SMART drumlines. They perceived them to be more effective than nets, owing to the greater catch of White Sharks and significantly lower rates of bycatch; and equivalent in terms of taking a proactive approach and resulting feelings of safety. In contrast, the majority of non-residents who responded to the online questionnaires did not

support the use of SMART drumlines, primarily due to concerns that sharks or other marine life are harmed.

The contrasting opinions of residents and non-residents were possibly driven by different experiences of and proximity to shark–human interactions, with non-residents unlikely to be impacted by shark bites in the same ways as residents. Non-residents responding from other locations may have different views and values related to shark–human interaction mitigation methods and marine conservation more generally (note: participants self-selected for the online questionnaire). It is generally understood that close experience of harm from wildlife increases emphasis placed on safety relative to costs (Kansky and Knight 2014). Non-residents were also less aware than residents of the SMART Drumline trials and catch statistics. This was not surprising given that the most extensive stakeholder engagement and media coverage had occurred locally. The reasons respondents provided for liking or disliking the use of SMART drumlines were generally consistent, regardless of place of residence. Reasons for liking included: limited impact on marine life, sharks were tagged and released, used for research purposes, that they were better than nets and make beaches safer. The main concerns included the perception that sharks were released but could return, so beaches would not be safer; bait could attract sharks; and this approach harmed sharks and other marine life (they were worried about operator response time). The main reasons for liking and disliking SMART drumlines were motivated by concern that sharks and other marine life were not harmed.

Preliminary social research conducted by NSW DPI at the four other trial locations (Coffs Harbour, Forster, Kiama and Ulladulla) suggested that while local community attitudes towards SMART drumlines were generally consistent with those observed on the Far North Coast, there were also striking differences, particularly regarding utility as a management tool. An estimated 521 people were engaged through drop-in stands at the trial locations of whom approximately 80% lived locally. While most people questioned were supportive of trials, this was generally related to their use for shark research (ie the tagging program). Most expressed a keen interest to learn more about sharks in their local area. Knowledge of how SMART drumlines were used as management tool was generally poor with many expressing confusion over the need for shark mitigation in the area – ‘we don’t have a shark issue’, was a common sentiment. Despite this, most participants conceded that this approach was ‘better than nets’ and they did not want sharks harmed or killed locally.

Similar to the North Coast, concerns over the use of drumlines were generally related to potential bycatch, and the perception that bait could attract sharks to beaches. In fact, concern over bait was expressed in all trial regions via on-the-ground engagement activities, through the local council, and phone calls to DPI.

The data DPI collected to date has provided important insights into community attitudes towards SMART drumlines across the trial locations. It also suggested some attitudinal differences within and across sites that warrant further systematic exploration. The present study was designed to focus exploration on local beach and ocean user attitudes to shark management at the sites where SMART drumlines have been trialled.

3 PURPOSE AND RESEARCH QUESTIONS

3.1 Purpose

To explore community attitudes and perceptions related to shark risk mitigation since trials of SMART drumlines

3.2 Research questions

What are the attitudes of beach and ocean users to shark mitigation since trials of SMART drumlines?

Sub-questions:

What are attitudes to and awareness of SMART drumlines?

What are attitudes to and awareness of VR4G listening stations and the SharkSmart App?

What are attitudes to and awareness of shark mitigation strategies generally?

4 RESEARCH METHOD

4.1 Focus Groups

Focus groups were used in this study to explore attitudes and thinking concerning SMART drumlines, VR4G Listening Stations, the SharkSmart App, and mitigation approaches more generally. Importantly, in focus groups, people are encouraged to listen to other opinions as well as express their own. They are a tool for studying groups with a perspective of special interest, and for developing insight into the range, depth and thinking on the focus topic(s). On their own, focus groups are not generally intended to be representative of large populations as a randomised survey study would. The findings tell us how and what people think, but not how many think this way, so we need to take care about generalising insights to wider populations. The participants in this study were people with an interest in the coast, including recreation, business, safety and environmental protection stakeholders.

Focus groups tend to be chosen for studies of attitudes and behaviours that are not socially sensitive, that is, topics that participants are likely to feel comfortable discussing in front of others. Focus groups were used here to explore specific topics of research interest, bringing together different perspectives to compare and contrast attitudes and experiences (Patton, 2015).

Particular care was taken to create discussion environments that put people at ease. This included the selection of venues and participants, the advance information provided, the structured approach to questioning, soliciting each participant's perspective, and promoting a confidential and non-judgmental ethos. A discussion guide (see Appendix) was designed to allow participants to feel valued, to feel comfortable in expressing their opinions, and to reduce the potential impact of group influence on the expression of individual attitudes. Participants were assured that transcripts would be de-identified and that reports would not include the names of interviewees. Ethics approval (protocol number H16172) was obtained from Charles Sturt University's Ethics in Human Research Committee.

4.2 Data Collection

Ninety minute focus group discussions were held in board and meeting rooms in surf, golf and ex-services clubs in August and September 2018. The five sites along the NSW coast were:

- Ulladulla (Mollymook);
- Kiama;
- Forster;
- Coffs Harbour; and
- Ballina.

The chief investigators led each discussion. PhD student Kane Callaghan attended the Kiama discussion, and contributing author Dr Belinda Curley attended the Forster and Coffs Harbour discussions, as observers.

4.2.1 Sampling

We gathered a sample tailored to the purpose of the research, rather than a random sample (Krueger and Casey, 2014). Our purposive approach was similar to Gibbs and Warren (2015) who targeted ocean users with a survey. We sought participants with an interest in the ocean as users as advocates for its conservation, or people who perceive livelihood benefits. Although their perspectives differ, they have in common some special interest in or experience of the ocean. We were interested in people's attitudes to shark management generally, their attitudes to SMART drumlines and listening stations specifically, as well as local or other contextual influences on attitudes. With the time and resources available for a study involving five groups, we elected to gather groups of ocean users in each of five areas around SMART drumline trial sites, rather than separating the groups by interest (ie a surfer group, a conservation group, etc.). This sampling approach was also guided by Patton's (2015) evaluation and diversity-focused varieties of the group discussion approach to research. With groups that were diverse rather than homogenous, the moderators were particularly attentive to the potential for groups to be dominated by people with more detailed knowledge, people from the small community catchment areas having prior relationships, and participants who may perceive their views to be in the

minority being inclined not to speak (Patton, 2015). To prevent some of these potential barriers to full and frank exchange, the interview design included deliberately setting up inclusive and non-judgmental ground rules at the start, and multiple turn-taking round-table questions.

The criteria for inclusion in the sample were:

- Participants must be aged 18 or over;
- Live or work within 30kms of centre;
- Be users of and/or interested in the ocean for recreation, business or conservation: Beach and ocean swimmers, surfers, divers, anglers, marine environment and coastal conservation, paid lifeguards, volunteer lifesavers, tourist operators and small business; and
- Excluded were DPI employees and individuals with a vested interest in a particular mitigation strategy.

The target sample size for each group was 8 to 10 people.

4.2.2 Recruitment

The main approach used to identify eligible focus group participants was online searching. An assistant used the Internet and telephone to research and develop contact lists for local (beach and ocean users) individuals and groups. The key search terms used were the name of towns and regions (Ulladulla - Narrawallee, Coffs Harbour – Sawtell, etc.) plus entity type (club or association or society) plus user type (boardrider or surf lifesaving or ocean swimming or chamber of commerce, etc.). Snowball sampling, where contacts were asked for names of other contacts who met the recruitment criteria, was also used. A list of potential participants was generated and then individuals were contacted by email and phone using standardised scripts for consistency in briefing and background information. An incentive of \$60 was given to each focus group participant at the completion of the discussion.

4.2.3 Sample

The sample is profiled for each group in Table 1.

Each group included a cross-section of beach and ocean users as planned. Participants included people with professional and amateur/recreational interests in the ocean. Importantly, the groups contained a substantial number of users who go into the water. Each group had at least four surfers, four beach and ocean swimmers, and at least one lifesaver, one conservationist, and one person from tourism/small business. There were 27 males and 16 females, and most participants were over 46 years old. For each group, approximately one in four people who agreed to participate did not attend. This attendance rate is consistent with other, similar projects with members of the public.

****Note:** Many participants had multiple interests/roles.

Table 1: Focus group participants

		Ulladulla	Kiama	Forster	Coffs Harbour	Ballina	Total	
1. Gender	Male	2	7	6	5	7	27	
	Female	5	2	3	3	3	16	
2. Relationship to shark study	Angler		3	3	2	3	11	
	Surfer	5	6	4	6	6	27	
	Beach / Ocean	5	6	4	6	5	26	
	Kayaker / Stand up board	2	3	3	3	3	14	
	Tourism / Business	1	1	1	2	3	8	
	Conservation/	1	2	1	2	1	7	
	Diver		1	3	3		7	
	Lifesaver	4	2	3	1	4	14	
	Other – please	Sailor						
3. Age bracket	18-25		1			1	2	
	26-35		2		1	2	5	
	36-45	1	4	1	2	3	11	
	46-55	4		3	4	2	13	
	56 plus	2	2	5	1	2	12	

4.3 Discussion guide

4.3.1 Line of questioning

We used discussions to listen to both the 'brain and the heart' (Krueger and Casey, 2014) in groups of beach and ocean users. Many say that shark fear and emotions are disproportionate to statistical risk. It was important to find out what people think about shark management in detached and logical ways, and also to find out how people feel.

Following Krueger and Casey (2014), we used several stages to develop the questioning for the discussion guide. As a group we reflected on research questions and topic under study, and then brainstormed a set of open discussion questions. The Chief Investigator then spent time refining the phrasing of the questions and creating a sequence that funnelled logically from a broader context to the specific topics of interest. The group again met to review and align the discussion questions with the project research questions. The questions went through several iterations of review and amendment.

The sequence of questions was standardised across the groups (Patton, 2015). To break the ice, an easy, factual question was asked to encourage participants to talk about ways that they use the beach and ocean before asking for opinions (Patton, 2015) on topics that led more closely to the subjects of shark management generally and specific strategies of interest (Krueger and Casey, 2014). The interviewers were mindful to use open-ended questions in the early stages, and avoid questions that might be likely to lock participants into certain attitudes they may feel they need to maintain and justify. Most questions were open-ended in ways that encouraged participants to 'determine the direction of the response' (p53). That is, these questions reveal what is on the interviewee's mind, not what interviewers expect is on their minds (p53). '[O]penness of inquiry' in questioning and researcher mindset helps to uncover unanticipated outcomes of programs (Patton, 2015, p11/12). Simmons and Mehmet (2018) have argued that policy makers can benefit from insight into unintended consequences of shark management strategies. Insights into the unintended help to complete a more nuanced picture, and may help authorities to better target communication and other action options.

Participants discussed the importance of knowing where sharks are, and whether that information should be made available to the public. They were reminded that there are aerial and in-water approaches to shark surveillance. After a general discussion, they were asked more specifically about VR4G listening stations and the SharkSmart App - strengths, weaknesses and future roles for these strategies.

A similar line of questioning was used for SMART drumlines. There was a general discussion about catching sharks, followed by a summary of SMART drumlines and the recent trials, then specific discussion about strengths, weaknesses and future roles.

To close the discussion, each participant was asked to respond to an 'all things considered' question about the needs and provision of shark management in the region.

4.4 Coding and analysis

4.4.1 Coding

There were several stages of coding. The first stage of coding occurred during focus group discussions where the investigators made notes. Within two hours of the completion of each discussion, the interviewers' notes were then used to identify and record salient topics, associations and justifications. The researchers coded collaboratively to enhance accuracy and consistency (Saldaña 2015).

The discussions were also taped and transcribed. The investigators performed abductive, thematic coding (basic level) against the research questions, by site. This occurred several times for some sections of the transcript.

The researchers drew frequently from four Affective coding dimensions (recommended by Saldaña (2015) for use in sentiment analysis) simultaneously, to develop understanding of themes likely to motivate action, reaction and interaction (Saldaña, 2015):

- Values coding reflected on participants' values, attitudes and beliefs representing their perspectives or worldviews;
- Emotion coding was used to explore feelings and reactions to experience and actions, and events;

- Versus coding identified individual and group preferences for mitigation in dichotomous or binary terms; and
- Evaluative coding assessed the judgements about the merits, worth, or significance of programs or policy (Saldaña, 2015).

4.4.2 Analysis

Analysis was performed in three stages. The insights from Affective and basic themes coding were negotiated between coders to identify higher order and meta-themes. These themes were used with verbatim quotes to develop narratives presented as the findings. The findings explain thinking associated with the shark risk mitigation, especially SMART drumlines, listening stations and the SharkSmart App. To ensure consistency of analysis across all focus groups, the researchers collaborated again to determine responses to the research questions presented in the discussion, conclusions and recommendations.

5 FINDINGS

The purpose was to explore community attitudes and perceptions related to shark mitigation since trials of SMART drumlines began. The findings are first presented by trial site:

- Ballina to Broken Head (section 5.2);
- Coffs Harbour to Sawtell (section 5.3);
- Forster to Tuncurry (section 5.4);
- Kiama to Shell Cove (section 5.5); and
- Ulladulla to Narrawallee (section 5.6).

The discussion section then reports across the sites against the three project research questions stated in section 2.2.

5.1 Key to identifying focus group comment sources

Verbatim quotes from focus groups are attributable to the towns where discussions took place, using the following key:

Ballina = B

Coffs Harbour = C

Forster = F

Kiama = K

Ulladulla = U

In each focus group, the participants introduced themselves and their association with the coast. Participants were numbered in transcription and are referred to as follows (for a Kiama example): K (Kiama) P2 (participant 2) = KP2.

5.2 Ballina – Broken Head

Table 2: Ballina to Broken Head main attitude findings

Main attitude findings
<ul style="list-style-type: none"> • Range of strategies in place, something is working, but we don't know what, so keep them all • A range of mitigation strategies is considered important for the high number of sharks • SMART drumlines' tangibility - catching and relocating sharks - reassures ocean users • SMART drumlines preferred to nets for catching more sharks and less bycatch • High awareness of and hope for SMART drumlines as a mitigation strategy • Behaviour change comes more from increased awareness of risk than SMART drumlines • We can't tag all sharks – there is always a risk • SMART drumlines are perceived to alter behaviour of sharks – that tagging shocks them and they stay away • Research is supported for the long term • SMART drumlines valued as one of a suite of mitigation strategies • Want alert information localised and directed to key decision-makers • Lifeguards and those with a 'duty of care' value the app, but surfers do not • Grateful to DPI for responding to the needs of the Far North Coast region when it was in crisis in recent years with locally embedded mitigation strategies and communication intended to reassure

5.2.1 Perceived shark mitigation needs of region

This section reports attitudes and thoughts on the mitigation needs in the Ballina region. Despite the reduced media attention, the prevailing attitude is that there is a strong mitigation need for the entire Ballina region. The sentiment in the group was clear that sharks are still around and still need to be managed.

Due to a recent reduction in shark incidents people were feeling more comfortable about entering the water again.

I feel a lot more comfortable myself. Um, say a couple of years ago, there were a lot more reports of people getting their boards bumped. Two or three years ago, I think that was a major part of it, wasn't it? About two years ago, so every day there'd be someone at Suffolk getting bumped by their board, or then it would be Brunswick a couple of days later or something like that, whereas there's a lot less activity that way. (BP10)

It doesn't stop me and I'm not fearful, but I am just a bit more aware of, you know, the chances of what might happen and you're just kind of a bit more aware, I guess. But it doesn't stop me and also we fly the drones and do the lifeguarding, and when we started doing it, I thought that we'd be seeing a lot of sharks and it would kind of spin us out a bit. We see them, but not enough to where I'm like, oh, like totally spun out by it. (BP5)

Yeah, I'm more aware of the risks, but I will still, if the water is nice and clear, I will still go out after sunrise in the morning. Even though I know that's a risky time. (BP3)

However, a heightened sense of vigilance, and an increase in personal risk management/assessment prevails.

I guess we're just more mindful of the birds that colour the water and just that risk management that you might take before you get in the water. A bit more of a risk management analysis that you might do on a personal level. (BP9)

Even with the DPI helicopter doing its patrols, there is a lot less sightings than what it was that time ago. (BP10)

5.2.2 Perceived value of listening stations and SharkSmart App

This section reports on attitudes towards and thoughts on the value of listening stations and the SharkSmart App in the Ballina region. There was strong support for the listening stations as a research tool. However, non-research related matters will be discussed below.

Alignment with local context

Considering the recent history of the region, participants value information in most forms. The combination of the listening stations, drones and helicopters to inform the SharkSmart App was highly valued for Ballina, both for research and mitigation.

The more advancement we have and the technology to advise us of the location and the information, what's going on at a time like that, is crucial because that would give us a lot more information during ... if we start getting occurrences of attacks and touches and bumps and things all happening in a short period of time ... it would be valuable to have that information coming through to give us an idea of what's going on out there. (BP1)

The popularity of the app depended on the role of the user. Those on patrol liked the technology, but surfers on the whole saw no need or had no desire to use the app.

... but certainly from a volunteering perspective, we need to know that they are out there. (BP9)

On patrol, yes, we need, you know, we need that information when we're on patrol. (BP9 + BP1)

Personally, I don't use the Twitter applications or the app. (BP4 surfer)

I've never used it. I rarely hear anyone that does, and I don't really think that there's a place for them ... I guess I said a bit of this, but all the guys that I surf with, it doesn't really come onto their radar. But yeah, I kind of think they're a waste of money. (BP6)

No, I don't check it out before I go. But on patrol, yeah, all of that information is really important if it can be, if the research can be provided to you in a format that is digestible quickly, too. (BP9)

For some ocean swimmers, the app and the information it conveys countered their lifestyle needs, and was seen as unnecessary.

But, I guess as an ocean swimmer, I don't have it on my phone and I didn't want to get continual pings about how many sharks were out there all the time. (BP9)

Likes and Dislikes

One of the positive aspects of listening stations and the app was the ability for people to enact choice. Information disseminated by the listening stations and the app was seen to allow people to make their own decisions, and could be used with other mitigation measures, especially if the person perceived they had a duty of care.

If the water is a bit murky, sometimes I turn it back on for a bit. So I still look occasionally, but hardly ever compared to a year or two ago. (BP3)

Yes. If I see the helicopter and it's hanging around for a long time, I might have a quick peek to see if anything's popping up. That's for a business perspective obviously ... the more information that comes up on the notifications at that point for me would be the duty of care that I have to my guests. If I can say, hold on guys, let that chopper sort out what he is doing. Because I can see that he's actually looking at something and he's not just checking out a shadow in the water. (BP1)

Despite support for the app, contextual localised and locally relevant information was highly prized. Lack of local relevance could be a barrier to usage.

But it has to be relevant to the person. I don't know how many people in here have turned their SharkSmart App off? (BP1)

... I turned mine off because it was too broad. So that might be the operating area, but it was far too broad in location. I just want to know about Ballina and Lennox, I don't really care what's going on in Port Stephens. (BP3)

There was also a distinction between usefulness for locals and tourists. The program has a 'public relations' angle, a use in placating or reassuring.

I don't use it, but I see a place for it. I think with any of them, the listening station that we were speaking about earlier, the apps or I think anything that is being implemented, I think it also plays a big PR role as well as especially for tourists and people not from this area. If I was a business owner, a tourist business owner, I think people coming to this area would definitely feel a bit more peace of mind having that information on them. (BP7)

Limitations were also expressed. Listening stations and apps were said not to work if the sharks were not tagged, and do not provide specifics that would be useful to decision making.

You've got to tag them first. They're dependent on tags. (BP1)

But they'll only get tagged sharks, so if there's anything that's not tagged, they're not picking those up. So that's why the drones supplement that. (BP3)

As far as I know, it still doesn't tell you how big the species is, does it, or where it is? So, it doesn't tell you the length of it or anything. So, you know how it is 500 metres out to sea, basically, and then it picks up in a 500 metres radius. (BP10)

Participants also did not like the fact the battery on the tags did not last. This cast doubts on the effectiveness of the listening stations in the future.

But yeah, the only downside to them that you could say was a negative was that the battery packs on the tags eventually run out after a few years and so then they become ineffective. (BP8)

Influence on behaviour

Some participants saw the apps as creating unnecessary fear. Many locals without a duty of care to others simply were happy using the beach without causing themselves fear.

From a surfer's perspective, no, because we are going to go in regardless, I assume. But from a lifeguard or emergency service point of view, um, because that is our job, I think yeah, that information will help us to make decisions with alerting people. But for a lot of people, I think for surfers in particular, they're not going to use it. But maybe swimmers, you know, people who are a bit more apprehensive about it and don't use the beach every day. (BP8)

Ah, yes, it does [influence behaviour]. On patrol, certainly, while you are at the beach and in charge of the beach, absolutely, you have to keep abreast of that. (BP9)

Personally, we probably don't really pay much attention to it. I wouldn't if I was going into the sea just myself, I am really not interested. I will just make the decision myself. But from a business perspective, for my guests, yes, I would be paying more attention. Probably only if I was alerted to it though, it would have to be a high incidence time when I'm going to pay more attention. (BP1)

Yeah, but for the people who surf every day ... you don't want to create fear within yourself. So, out of sight, out of mind, kind of, you know? (BP7)

However, lifeguards were aware that using the device while on duty can have consequences. Being seen to be looking at your phone while on duty is 'a bad look'. Attention may be taken away from other dangers on the beach, such as rips or people drowning.

Yes, but you still can't be, as a lifeguard, it looks really bad to be sitting on your phone to find information to call people out. Obviously, a shark is a risk, but there's more of a risk to people swimming in the water, just rips and drownings in general. (BP4)

5.2.3 Implementation concerns with listening stations and apps

There were no concerns around implementation from a local point of view. On the whole, people felt the DPI did the best they could in extreme circumstances.

Yeah, I think it's a tough job, but I think it's being managed as well as possible and with learning and experience, time will tell with everything we do if it works or not. (BP7)

Between all the things that they've got going, it's a lot more than they did before we had our spate of attacks. So, I think there's been a good effort to try and do something, whether it be from the helicopter, the drone, the pingers, the drumlines, I think they've all helped. And so far, it seems to be working. (BP8)

Yeah, I think the DPI have been fantastic in their support of us living in this area and their wanting to support us and help work out why it happened and what happened. It's given them a lot of research data, but that's all been great. The DPI have been fantastic. (BP9)

That being said, some participants speculated that some of the mitigation measures may have unintended consequences. For the app, this may include an increased fear among tourists, which needs to be considered.

I think the app has its place, but I also think that the government should be aware of the fear of the app going off all the time in different areas and that that can create a downturn in tourism numbers. For people who don't use the beach all the

time, and might, you know, drive down from Brisbane or come up from Sydney, and they're not used to going to the beach every day and hearing the app going off every day, it might just turn them away from visiting the beaches. (BP2)

Some participants were concerned that no long term plan for shark management or ongoing research had been pledged by the government.

We still need to be vigilant with it. Because ... where we are, there's no shortage of marine life around us. And I think with Byron being a marine zone as well and the increase in marine life, because things are protected now, I think it's important to stay vigilant. Yeah, I think it's good to do feasibility studies and not just put something in place and go, well, we're done with it now. You've got to be constantly updating the research and making sure that you're catering to the changing needs of the environment. (BP6)

Um, it's just got to keep continuing and hopefully with all the research and data coming in, we can formulate the patterns and we can have a bit more information and, hopefully, money is going to be a part of it to keep it going. (BP8)

5.2.4 Perceived value of SMART drumlines

This section reports attitudes and thinking concerning the value of SMART drumlines in the Ballina to Broken Head region.

Alignment with local context

The group said that more than a year has passed since the last serious incident of shark harm in the region. Eighteen months ago, the prevailing emotions were shock, anger and despair at horrifying incidents that had taken human lives and a coastal lifestyle that had been a feature of the region for generations. There has been a transition in attitudes and emotions. In September 2018, the mood of this group expressed several emotions associated with the sustained period of time free of shark-related harm incidents.

Yes, I think even though there have been no real attacks in recent times, I think the need is still high. We still need to be vigilant with it because of we are where we are, there's no shortage of marine life around us. And, I think with Byron being a marine zone as well and the increase in marine life, because things are protected now I think it's important to stay vigilant. Yeah, I think it's good to do

feasibility studies and not just put something in place and go, well, we're done with it now. You've got to be constantly updating the research and making sure that you're catering to the changing needs of the environment. (BP6)

They were relieved and less fearful of the water, yet committed to personal vigilance and a range of strategies for reducing the risk of harm from sharks.

There was also some pride expressed in the international standing of the shark research done in the region.

... we're in the top two percent or something of leading research in the world. That's where we currently stand on New South Wales DPI shark research. That's amazing. We don't want to lose that. We want to be able to talk about this to our grandchildren. I remember when that first started. (BP1)

However a surfer said we need to prioritise safety of humans at risk:

... all I really care about is not getting eaten by a shark. So if the drumlines were open, I'd rather put more money into that and keep that going than studying where sharks live, because that doesn't bother me. (BP5)

Likes and Dislikes

There is an awareness that SMART drumlines have been in operation in Ballina-Lennox Head since December 2016, and this is associated with a period without harmful incidents with sharks.

I guess a lot of these things, for whatever reason, if it's working or something has changed, we don't have as many sharks coming close to the area, whatever it is. I mean, there's been no attacks, so if it is working, that's great. (BP7)

... they are catching the sharks and they are obviously working in some capacity. Whether that's the main reason that we've had a reduction, I don't know, but there's been less attacks. (BP6)

That's definitely something tangible that people can see is happening. (BP6)

Participants understood that correlation and causation are different. Maybe the SMART drumlines work, maybe it is the combination of strategies. Perhaps they have no effect.

Whatever, something 'seems to be working' and SMART drumlines are largely viewed favourably.

I don't know whether it's coincidental, but since they've started using them, there's been less and less encounters. (BP6)

Generally, the group said they liked SMART drumlines because they catch a lot of sharks. 'They are tangible' and they were perceived to accomplish what they are intended for. They were liked both for removing the shark from close to shore and for contributing to understanding of sharks. Participants were supportive of research into patterns of shark behaviour and movement.

Yeah, it's important, because the amount of ... how many juvenile whites have been tagged off Ballina? Like, are we up to 200, 300? (BP4)

The SMART drumlines, they're great. Obviously they do catch a lot of sharks, and they're great for catching and tagging and releasing sharks obviously for research purposes. (BP4)

Well, they seem to land sharks and then they remove them and there's been no attacks, so maybe they work? (BP7)

Some also said they believed that SMART drumlines catch the more aggressive and curious sharks, and this was viewed very positively. Thus they catch sharks that might have been more likely to be aggressive to a human.

I think an aggressive shark might get that [bait] more than one that is just cruising by. Um, and that probably takes the risk out of people in the area surfing or something like that. Yeah, I feel like that probably works. (BP5)

The group, and surfers especially, said they greatly liked the idea that SMART drumlines scare the shark once caught. The time on the hook and the experience of tagging may be sufficiently traumatic to deter the shark from returning to the locale.

Yes, they're traumatized and they're physically dragged away, too. (BP3)

I think that the SMART drumlines have been pretty good, only because they scare the shark, possibly? I don't know. But I feel like just catching it and getting the data is awesome, but I also think that it might scare the shark from that area. (BP5)

They tag, they tow them out to sea, and then release them. The experience so far is that the shark will continue going in the direction that it was towed out. (BP2)

One participant speculated that memory of this traumatic experience may even be passed on genetically to their young, and break patterns in behaviour.

I don't know if anyone has heard the rumour that it is like inter-generational, when things happen to a certain sharks they pass it down to their juvenile sharks and it's in that brainwave of certain traumas within the brain that if something happened there, they might steer clear of it and they might pass it on to their shark and their spawn or whatever. (BP4)

The group had mixed beliefs about whether SMART drumlines influenced water safety. Swimmers were more likely to perceive improved safety than surfers. Some clearly associated SMART drumlines with lowering risk of dangerous shark encounters.

Bloody glad there was one [SMART Drumline] at Skull Candy because it got one right in the middle of the comp and that could have been one of our children. You know, I mean I'm not taking that assumption, but just knowing that that was happening at the time, it was good to know that the drumline got it instead of anything else. (BP1)

Some participants said they felt that the SMART drumlines bait actually increased the risk of encounters with dangerous shark. They were reluctant to swim when they are in the water 'because they attract sharks'.

Yeah, but I actually think that having the bait there would bring the sharks in. I don't know. That's just what I think. I'm not sure. (BP3)

I think the drumlines are great for research, but I actually don't often go to beaches where there are SMART drumlines any more. I think they are too close to the actual areas where there are lots of people. (BP3)

Others emphasise that SMART drumlines cannot catch and tag all sharks, and that perhaps they give a false sense of security.

If you are trying to catch sharks to deter them or whatever, you are not going to catch every shark. The ocean is very big. Sharks are going to come in and you're going to miss them. They have no borders, so there is nothing stopping other sharks. (BP4)

So, yes, it's great that you do feel a little bit safer because one shark has been taken out, but should you be? You know, because there might be others there? It's a very hard question. (BP2)

There remains much unknown about SMART drumlines. Many want to know shark behaviours and outcomes after their release in the short and longer term. Uncertainty and speculation influence attitudes to SMART drumlines.

Has there been much research done into, yeah, so when they leave, are they high tailing it out of there? Are they angry? What do they do once they leave? What do the tags do to them long term? (BP7)

Some participants said they believed that the sharks move away, and they like this a lot about SMART drumlines.

... the research shows that they do move away from the area, generally straight after the tagging. (BP6)

Yeah, from what I heard about the feedback about them, how when they've caught them and they've kept on going seaward and moved out, they sound pretty effective that way. (BP10)

They've very rarely returned in a recent time period. (BP9)

They tag, they tow them out to sea, and then release them. The experience so far is that the shark will continue going in the direction that it was towed out. (BP2)

One participant said that SMART drumlines are expensive and complex to maintain. There is set up in the morning and retrieval in the evening, the tagging and relocation processes when a shark is caught, and a crew must be on standby for immediate dispatch whenever a shark is caught.

There's a crew of two, and they respond. They actually have to sit in the boat all day waiting for a shark, so they are there on-call all the time. (BP2)

Perhaps relatedly, there is hope that technology will improve and make the SMART drumlines more efficient and effective in the future.

I think the technology can be advanced. There's a future for them, and there's a better future for them. I think more technology can get put on them. I want to see

*those algorithms going in there and telling us more information about the sharks.
(BP1)*

The group were almost all opposed to harming sharks if possible. However several participants were in favour of killing a shark that had harmed a human.

I reckon they should catch it and kill it because it's one there that is a killer. (BP4)

Influence on behaviour

The group reported that fear of the waters has greatly diminished over the past 18 months. The mitigation strategies and the end of serious incidents have helped the community to feel more secure. The 'tangible' catching and removing of sharks contributes to reducing fear.

... they are catching the sharks and they are obviously working in some capacity. Whether that's the main reason that we've had a reduction, I don't know, but there's been less attacks. That's definitely something tangible that people can see is happening. (BP6)

It's a lot better than it was 18 months ago. (BP7)

It's not at the top of everyone's mind every time they enter the water. (BP8)

Some participants reported that behaviour has not changed since the introduction of SMART drumlines. They said there were sharks before and there are sharks now.

We all pretty much believe that it doesn't matter what happens out there, we can all still do our own thing. The shark, the drumlines and all of the technology that was there, it's heightened our awareness, but it hasn't changed our behaviour. We still use the water in the way that we were using the water. (BP2)

I guess it doesn't really affect, I don't think it makes me feel dramatically safer, but once again, being part of a broader system of technologies working together, I guess it can help. (BP8)

Most of the recent behaviour changes the group reported arose not from SMART drumlines, but from increases in awareness of risk, exercising caution, and taking personal responsibility since the local waters became a place of fear in recent years.

I guess we're just more mindful of the birds that colour of the water and just that risk management that you might take before you get in the water. A bit more of a risk management analysis that you might do on a personal level. (BP9)

Some participants said they felt the SMART drumlines attract sharks, are too close to shore, and they avoid swimming near them.

I think the drumlines are great for research, but I actually don't often go to beaches where there are SMART drumlines any more. I think they are too close to the actual areas where there are lots of people. (BP3)

5.2.5 Implementation concerns of SMART drumlines

The group expressed considerable support and gratitude for implementation of a range of strategies to reduce risk from sharks, at a time when the community desperately needed support. Several said that Ballina had been traumatised and needed support urgently at the time. The DPI was acknowledged for providing a range of strategies intended to reassure, and to protect as far as possible, in a time of need.

The main concern expressed about implementation was that resources need to be prioritised to continue both harm mitigation and research into the future.

It was a really concerning time for us, and putting our members in the water and our nippers in the water and then the public as well, so the DPI, they were really supportive of the situation, we felt. But they also said, they couldn't explain it and fix it overnight either. That was never going to happen. (BP9)

It's not a bottomless pit of money there, I'm sure. It's great what they've done, it's much better than what it was. (BP10)

A specific Far North Coast strategy as a focal point has been very lucky for us. We've been really grateful for that. I think that's really an awesome score for our community. It's the tip of the iceberg. The research has literally just started. (BP1)

There is a finish date and we want to encourage them and give them a reason to keep it going. (BP1)

Some participants expressed concern that the management strategies should be better integrated, and that, if research ceased, it could be wasted: That shark cycles and seasons could span many years, and it might take decades to identify patterns.

5.2.6 Mitigation preferences

This section reports participants' thoughts on risk mitigation and preferences in the Ballina region. There was considerable agreement that a more integrated and coordinated system should be in place to take full advantage of all the mitigation methods at their disposal.

Altogether, the aerial surveillance, the drones, the listening stations, they all give you information. I don't think there's any one that is better than the other, and some work when others don't. (BP3)

But we would use a combination of drones, helicopters and apps, so all of them to keep the public safe. (BP9)

I think when the DPI first started their research or their investigations a couple of years ago in this region, the expression that they used was we are presenting a tool, these are all tools in the tool box. I think that is completely appropriate. We have many tools in our toolbox and different tools in that toolbox will be used to fix different strategies and solutions. Yeah. And if they keep inventing new tools, the funding is nice. (BP1)

Yeah, for sure. It's great to have all the tools and that, and the drone, over 20 knots, you can't fly it in rain or anything, but then you've got the Smart thing, the app or whatever that notifies you. But with all of them, you need someone to go and advise you, because if you're in the water you don't have your phone to know that there's a shark in this area. (BP4)

However, a more extreme version of this sentiment was also evident. Some participants supported further funding, greater levels of new technology exploration, and better integration of research, with the ultimate aim of arming a vulnerable community against further trauma.

The research creates information, the information informs the community and the community pushes the money makers to fund the research, to fund the technology to protect the community. It's a cycle. If we don't keep researching we don't keep

informing. Our community doesn't find out more, they don't realise, oh, there could be a better version of a drumline or there could be a clever buoy. If everyone finds out what that is, then they push their politicians to put more money towards it, they support DPI. This thing isn't an ongoing thing, this research that the DPI is doing. There is a finish date and we want to encourage them and give them a reason to keep it going. (BP1)

I think they've taken just small areas of the research, looking at very small areas. They haven't integrated it into a bigger picture. I know that they haven't got a handle on what it's costing, and when they do, the community is going to say, that's too much. They are going to come back at businesses like mine, a tourist business, and say that you have to pay for this. The guys that do it during the middle of the week, someone has to come along and say, you have to pay for this. So, we haven't got an integrated approach to the shark problem. Um, they do need more research, I know, but the research will dry up. It was only put in for a two-year period. I think they got an extension of one year. What happens after that one year is over? They haven't got all the information. The sure thing is that if it is not integrated they've got to do a lot more work. (BP2)

I'm glad they're doing it, for sure. But like anything, money dries up. I just hope that they keep some of the things they've found working because all I really care about is not getting eaten by a shark. So if the drumlines were open, I'd rather put more money into that and keep that going than studying where sharks live, because that doesn't bother me. (BP5)

Participants said listening stations were a valuable asset. However, people wanted specific information about the size, number of sharks (is it one shark five times or five sharks?), location of shark near swimmers, and the direction it is travelling.

It's gone off 20 times, so you know that there's one around. It would be a great thing if they could, when they tag a shark, if they could say it's 2.5 metres long and then it's June 2018, so that when they notify you, they can go, oh, it's HB, which is when it was tagged in June 2018, it was this long, so you know how big the shark is. Also, is it the same shark going back and forth past the pinger, or is it 20 sharks? You don't know that, they just say the pinger has gone off 20 times. (BP6)

If it is two kms out to sea, it's like we don't need to know that. It's not a danger, but in that sort of immediate area, I think, yeah, for sure. (BP4 +BP1)

If it's gone off 20 times, you don't know whether the shark is a kilometre out or off Byron Beach at Byron. It could be 10 metres off the break. That's a big difference as to whether you need to clear the water or not. It needs to be more specific. (BP10)

Aerial surveillance, helicopters and drones were seen as essential to the tool kit. Helicopters were, however, seen as being very expensive compared to drones. Participants said they also liked the idea of aerial technologies having sirens for instant warning.

Yes, there's been times when there's been a Big White, like 3.5metres or four metres, at the wreck or Wattego and there's heaps of people in the water, like really close near them. So, 20 metres away and they were just sitting there. So, the helicopter has come down and let off its siren and got everyone in. Sure, that's scary for everyone on the beach and everyone is like, what is it, what's out there? But it's a good preventative action, isn't it? There's a risk there. So in those cases, I think that sort of communication is great. (BP4)

I just think the drones are really much better for alerting people in real life of where they actually are and what's going on. (BP3)

Oh, I think they set off a siren or something. Everyone gets the idea. But yeah, you can't have a chopper in the sky every day. (BP5)

As in the drones more, because everyone seems pretty much in favour of the drones as a good tool. (BP10)

Word of mouth and visual information in the form of flags on the beach notifying the level of shark danger, were also well regarded. The community were ready to suggest many tried and innovative approaches to improving shark risk information.

A flag in the system would be really good where you can have the alerts, where the flags are a different colour for the amount of time that has gone past since the shark has been sighted, and even just the lifeguards having something written on their board where they've got the swell conditions. (BP9)

What about a sign on the beach, like you said, for the whole beach? So, not necessarily the track, but it is planted for the alert level if a shark has been hanging around say at North Creek or you could have a green or yellow if it has been around a few times or red, and the red one has been around a few times. So, depending on how big a shark and how many times it has pinged. (BP6)

I remember a friend of mine discussing in America the walking tracks. They just have a chalk board. It's not a patrolled thing, there's no bush version of a lifesaver there, but it's a place where everyone goes for recreational tramping. And they literally just have a board there that the trampers use, and it says 9:45am, Tuesday 24/9, spotted brown bear, and it's a bear sign. It's their version of our shark sign, and it literally is where the walkers are themselves. (BP1)

5.3 Coffs Harbour – Sawtell

Table 3: Coffs Harbour to Sawtell main attitude findings

Main attitude findings
<ul style="list-style-type: none"> • Waters considered generally safe; Coffs questioned as a site for trials • Trials have substantially raised awareness of sharks • SMART drumlines valued for research to aid future proofing (ie have a response in the event of a spate of attacks) • Low awareness of SMART drumlines as a mitigation strategy • SMART drumlines perceived to attract sharks to waters without a shark problem; should be located away from populated water • SMART drumlines liked for tagging without harming sharks, and knowledge that helps promote a healthy ecology • App has less influence on frequent ocean users than it does on infrequent users through lifeguards • Need to improve systems for communicating alerts and information to professionals with a duty of care • Preference for aerial surveillance, especially drones and shark towers (both with siren), helicopters considered costly and environmentally unfriendly

5.3.1 Perceived shark mitigation needs of region

This section reports on attitudes and thinking towards the perceived shark mitigation needs of Coffs Harbour-Sawtell. Most participants said there was a low need to mitigate the risk in Coffs Harbour. Their judgement was based on several factors: for some it was the low density of the human population.

... if that's the small region, then I think we're managing fine, because we don't have as large a population as some of the city centres, so we don't have to worry so much about as many people coming in the water. (CP5)

It was also because Coffs Harbour has neither a major river system nor a history of shark incidents. That said, participants did say that further south towards Sawtell there is a river

mouth near a headland. That area has a reputation for being ‘sharky’ and did need some level of shark mitigation.

I think Coffs Harbour is probably lucky in that we don't have a big river that is a breeding ground for sharks. So, that just means we are quite lucky. It doesn't mean that they're not out there. There have been a few attacks, but not many in this region. (CP4)

Where we primarily surf would be down at Sawtell near the island at the front of the surf club, but on the other side of the headland is where the creek of the river comes out, and that could be notoriously sharky. I guess you could say, because there's that feeder of fish coming out of the river mouth, so you could get the predators coming in. (CP5)

Some participants questioned the decision for Coffs Harbour's selection for a trial.

Ballina is the place to get eaten by sharks. No sharks in Coffs Harbour. Only in Ballina. (CP7)

Most agreed that mitigation of shark risk needs to be contextual, focusing on time (eg sunrise and sunset and after rain), and place/conditions (eg where events occur such as bait balls).

The other thing ... would be bait fish. (CP4)

[P]articularly around river entrances. Sunrise, sunset ... (CP3)

... which [means] don't go swimming in dirty water after rain. (CP3)

5.3.2 Perceived value of listening stations and SharkSmart App

This section reports on attitudes towards and thoughts on the value of listening stations and the SharkSmart App in the Coffs Harbour region.

Alignment with local context

Lifeguards have witnessed a shift in consciousness regarding sharks alerts since the trials began. Sharks are now a priority for them, when previously they were not front of mind.

So probably up until when this started, there was probably on a scale of one to ten, it was probably a two, with one being virtually unimportant. But, [now], this is now probably an eight. (CP6)

Participants noted their importance for beach authorities. Beach authorities need to use VR4G and apps to keep people safe, as they have a moral obligation aligned with their duty to ensure public safety.

Yes, so definitely at work. It has changed the way we treat that as a confirmed shark sighting, so the beach is then closed for a period of two hours and if we didn't have the app, if we didn't have the iPad that worked, we wouldn't have that limitation. So, yes. (CP6)

Not for me, the user of the beach or the water. If I was working as a lifeguard or something like that, I would see the value in having it because essentially it would be my job to ensure the safety of others. (CP5)

However, the combination of listening stations and apps was seen as useless for surfers or ocean swimmers if they were in the water. For these water users they saw taking responsibility for themselves as the best defence. That said, they acknowledged value in using the listening stations and apps for beach management.

You're not going to carry your phone on you when you're out there having a swim or a surf. (CP7)

Not for me. (CP7 + CP6 + CP5)

The responsibility is sort of on me. If I'm swimming in an area where I can't hear the alert, but if I'm swimming at the beach between the flags and then there's a confirmed shark sighting, it's kind of the responsibility of others to ensure that everybody gets out of the water. So, I can see in that instance, but for me personally, no. I don't have many things like that on my phone and I don't really use it. (CP5)

Finally, some participants mentioned value of the SharkSmart App for cautious members of the public that felt some level of fear or trepidation about encountering sharks.

Probably not particularly relevant to me, but for cautious people who are terrified of sharks and like to go and use the ocean, they might need to check that maybe that certain beach was safe for them at that particular time, yes. I think it definitely has a purpose for certain groups in the community. (CP4)

Likes and Dislikes

The group believed that these technologies were important for tracking shark behaviours for beach safety and for research purposes. They liked the fact that the technology had research applications.

So, I think for that kind of thing to know the movements of a particular shark or a species of shark is probably the greater benefit, to give us an idea of where they're congregating and so forth. (CP5)

I think it would probably be good for research purposes. (CP4).

Yes, I'm a fan of the attention that everything is getting, and the funding is going towards it so the technology is out there so that, again, like everyone is saying, the research. I've done tours of talking about sharks and things for 20-odd years and one of my opening statements always was the thing we know about sharks is that we don't know anything about sharks. So, from this data long term, we can learn these things and we might find that there's a breeding aggregation of whites off the bar at Ballina in between January and February every year. We are learning these things and then it is up to you to make the decision. (CP1)

Some participants suggested that the technologies through research may help to assure a healthy ocean, and create harmony between species (human and shark).

I like the whole research thing, I like to know the whole thing of, we've got them in the ocean and when their environment is healthy, the rest of the ocean is healthy. And so that's, I know they're not cute and cuddly, but that's what I was sort of thinking. If their numbers are healthy, then the oceans that we live in will be healthy and we can, you know, have a nice harmonious swim together. (CP2)

Despite hope and positive sentiment towards the listening stations and the app, a major dislike was the non-specific nature and overload of information transmitted. Many participants abandoned the app because of information clutter and irrelevant notifications. Essentially, participants wanted technology that was specific, and met a set criteria.

In the end, I didn't really want to know. So, I stopped. I'm not following that anymore because I got it in all the places I wasn't, and a lot of them I didn't really need to know that they were there because either I wasn't going to the beach at that time or I wanted to go to the beach and I'd rather not know that the sharks were there. (CP4)

The world is driving with technology, so I think for future reference, the beacon can tell you that a shark has been sighted or it's 200m north or east of the beacon, so that you know exactly ... you know because you said before, it could be a km out. Well, that doesn't matter, but if it is on this side, it matters. (CP2)

I don't want to know if a mullet swims past, who cares? But if it's a White Shark over 3.5 metres, narrow it down to things that can potentially harm you. But if it's a leopard shark or a Port Jackson Shark, it just doesn't matter. (CP1)

Influence on behaviour

There was a tone of annoyance and despair among lifeguards as they indicated that local beaches were closed more often due to shark sighting than perceived increase in threat. This impacted beach usage behaviours by local and tourists.

The only way that you can say that it changes the way the community uses it is that we react differently now that the shark beacons have to be 500 metres off the actual beach. So because the beach has to be closed, we are reacting differently. If it wasn't for that, the beach would be open at those times. (CP6)

The participants that identified with this position indicated that it would have been 'business as usual' without the technology, with no greater risk to the public. Furthermore, others mentioned that use of the app created fear and anxiety among some in the community and kept people unnecessarily from going in the water.

I think it changes the way the community uses the beach if a lot more people had the app and were actively using it for that particular purpose, because I think then

more people would be aware of the movements of the sharks, perhaps, and that then may influence their use of the beach. (CP5)

Participants who used the water regularly stated that the listening station had not impacted on their behaviour, with some never bothering to download the app.

I don't think it changes my use of the water, knowing that it's there. (CP5)

... ignorance is bliss. (CP2)

No, I don't do apps. (CP1)

Some participants who identified as swimmers said that the listening station was useful as a marker, and felt no fear using them as part of their daily swim routine.

Yes, it's a very good marker when we go for a swim because we say, okay, meet you at the shark beacon. (CP8)

Interestingly, rather than that keeping people away from sharks, an eco-tourism operator said they saw capacity in the technology to assist in their business. The app/technology could be used to track sharks down, saving the operators time and money in finding sharks.

... from an ecotourism point of view, if you've got the knowledge that this particular species hangs out in this area at this time of the year rather than just randomly throwing some divers or whatever in, I would go the other way and I would go out looking for them. If there's whites out on the island, let's go. Let's get some footage. Like I was saying, it is almost impossible to tag them all. (CP1)

5.3.3 Implementation concerns with listening stations and apps

There some dissatisfaction and concern with the positioning of the listening stations. This was based on shark movements perceived by the locals.

And a lot of the sharks don't come in that close. They pick them out there, but they don't pick them in there. So, maybe the location should be more related to the swimmers if it's going to alert the swimmers. (CP6)

There was an expression of dissatisfaction that the DPI had not raised sufficient awareness of the listening stations.

I don't necessarily know that people know what it is for. (CP7)

There was also cynicism about the trials, that they had been conducted to be seen to be doing something, and not solely mitigation.

That's the whole net thing. I think people just want the government to solve all the problems and do something, and if you do nothing and someone gets eaten by a shark, [then] whoever that was that signed off on that, gets their arse kicked.
(CP6)

5.3.4 Perceived value of SMART drumlines

This section reports attitudes and thinking concerning the value of SMART drumlines in the Coffs Harbour to Sawtell region.

Alignment with local context

The prevailing attitude among the group was that the waters are safe, but one needs to be mindful of some locations and conditions.

I think it's more dangerous getting to the ocean in your car. So people talk about being scared of sharks ... we've got every reason, but there's still a lot more, plenty more dangerous things that we do every day. I think the odds are in our favour, really. (CP2)

I think it's probably a bit more about like location as well and perhaps the beach that you may go to. Where we primarily surf would be down at Sawtell near the island at the front of the surf club, but on the other side of the headland is where the creek of the river comes out, and that could be notoriously sharky, I guess you could say, because there's that feeder of fish coming out of the river mouth, so you could get the predators coming in. And some beaches just seem a bit more scary than others. (CP5)

There was support for SMART drumlines, but mostly for the tagging and contribution to understanding of sharks.

I think of it as more of a research thing that will probably help later down the track, rather than deterring sharks at the moment. It's more so let's get our research done and then we'll come back with some options. (CP8)

Focused on the tagging role, one participant said they felt the SMART drumlines should be away from populated areas.

I would have preferred if they would have done it at areas like Woolli, that long stretch of beach between Ungarie and all the way down through sand and all that unpopulated area where not so many people use the ocean and they can catch the sharks and do whatever they want with them there. But they're not. I don't see it as a member of the public would want to use the ocean. They're not there, they're out of sight, they're out of mind. (CP6)

Overall, participants supported SMART drumlines as a means to tagging sharks in an area with heavy water use, but there was low awareness of and belief in them as a short term risk mitigation strategy. At the end of the discussion several participants said that SMART drumlines have value to the region, but need to be located carefully where they will catch and relocate sharks, but not bring them closer to people in the water.

Likes and Dislikes

Participants said they liked that SMART drumlines can tag sharks and improve understanding, without harming the sharks. They were opposed to cruelty and bycatch associated with mesh nets.

So, SMART drumlines. Research, I think they are fantastic. Sharks, no one knows anything about sharks and we are learning about sharks, what they're doing and where they're going and all of that sort of stuff. I think that you've got to tag them. (CP6)

I think I'm okay with it, if they're not harmed and they have a tag and then they can swim off their merry way out to sea. (CP2)

I think for the purpose for which it was designed, which was to catch the shark, tag it and then release it, or remove it from the area and release it somewhere else, is fine. I don't think it acts in any other way as a deterrent to make you feel safer at the beach, for example. (CP5)

It certainly doesn't act as a safety measure, but it's purely for gathering information and then, like for research purposes, it is good that you catch and release. I don't think you should harm just for the sake of catching a shark just for the hell of it. (CP5)

Some participants said they did not perceive the SMART drumlines as making the beach safer. They mentioned that mesh nets would be more likely to reassure swimmers entering the water. One participant questioned the wisdom of a program that cannot hope to catch all sharks.

You are just getting a random shark, basically. You get one, but there's that many out there. You've got a drumline and you pick up a shark, it's just the unlucky sucker that got there first. I suppose you've probably got some, I don't know, scientific, [benefit] that you guys are going to gain out of it, what benefit are you going to get out of it? The guy that won the lottery and took the bait, but yeah, I don't know that there's a lot to be gained. (CP7)

Well, I think ignorance is bliss. People think the nets are blocking everything, but they're not. They're killing stuff and we are gradually getting that message through. Now they're getting SMART drumlines, but are they really going to save us? (CP6)

There is also a feeling among some participants that SMART drumlines attract sharks, are too close to the shore, and make the beach less safe.

They're pretty close up that end of the beach, aren't they? (CP5)

So, I found myself and my mates surfing further away, so going surfing at Shelley's, Emerald Beach, all that sort of area, Sapphire, getting away from these things, because I didn't like them. I didn't like the thought that there's a hook on that with food, and they can smell it in the ocean and something might take it. And then from there, the contractor comes all the way across to there and it could get off the hook. I don't know, it could still be sniffing around. (CP6)

... they'd pick up more animals way out than in closer to the coast, so therefore, why don't they take the drumlines further out, which might just attract the shark? Or what are they trying to achieve with the drumlines, saying that if there's a shark here, we'll catch it? (CP1)

Two participants explained why they felt that SMART drumlines should not be used near populated waters. One emphasised that they attract sharks closer to people in the water.

But if the bait wasn't there, and the bait was further out, wouldn't the predator move further away as well? ... The thing that is bringing the sharks in is further

away from where you are. I didn't realise that it was supposed to be a deterrent. I thought that the SMART drumline was supposed to be for research and stuff like that. I can't see how putting bait in the water, near where people are, to catch sharks and then remove them, makes the environment safer. (CP7)

The other emphasised that there are plenty more sharks in the water than those that are hooked:

I was going to make an analogy, you've got a dog urinating on your front yard that you don't like. So you hang a chop out to catch the dog. When the dog takes the chop, you kick the shit out of him and move him along so he doesn't come back. But there's still plenty more dogs out there that you've missed that are roaming around that are still going to come in where you're gardening. (CP3)

The group said they liked the role in tagging and research, but not for risk mitigation. They felt there was a need for more information about SMART drumlines.

Wouldn't the shark, you know, come back? (CP8)

Well, what if there's more than one? You know, the first one takes the bait, what about the second one? It's hanging around. Well, there's a swimmer. (CP1)

There was a suggestion that prolonged use of SMART drumlines with their bait could change the local ecology in a profound and enduring way.

If we continue to do this, perhaps if a location is known to have a free, easy food source, then that information may get passed down from species to species. You know, mother Great White to baby Great White, and so on. (CP1)

There were many questions participants said they felt were unanswered about what sharks do and where they go after they are tagged, and whether they unnecessarily attract sharks nearer to shores where people swim.

Influence on behaviour

In the main, the group said that SMART drumlines did not influence their behaviour in the water.

If there were 50 drumlines off the shore at Park Beach, that's not going to make you feel safer going in the water, in fact it would probably be the opposite. Um, whereas if there was a shark net, for want of a better term, that stretched from one

end of Park Beach all the way to the other, that would probably make me feel safe going into the water, but it would also make me feel disappointed that turtles and dolphins and other things, sting rays are going to get caught as well. It certainly doesn't act as a safety measure, but it's purely for gathering information and then, like for research purposes, it is good that you catch and release. I don't think you should harm just for the sake of catching a shark just for the hell of it. (CP5)

I don't think it would affect whether I would go in the water or not, I am assuming they're quite far out? (CP4)

However, some participants said they felt that SMART drumlines attract sharks and should be avoided. Surfers tend to go further from the shore and many avoid the waters around SMART drumlines.

I probably wouldn't swim around it! (CP2)

That's personally, my personal wanting to go surfing before work and on the weekends, I will go away from them. I don't want to be near them. Yeah, I'll go somewhere else. (CP6)

That was never going to stop people wanting to go in the water, those drumlines. It was going to gather more information to enable them to put some different safety procedures in place, but I don't think the drumline was ever designed to make people safe about going in the water because I think most people feel safe going in the water when there are nets. (CP5)

SMART drumlines influence the thinking and behaviours of surfers. But in the main, the group said they felt they had little influence on people's behaviour in the water, and did not make the water safer.

5.3.5 Implementation concerns of SMART drumlines

A lifeguard said that the SMART drumlines can be a sobering reminder of the proximity of very large sharks to the shore. Mindful of a duty of care, he wondered what was the appropriate way to deal with knowledge of large sharks close to the shore.

At work, they were a real pain in the arse, these things, the SMART drumlines because we'd watch the boat come, we would be banging into the wind and we'd

pull up alongside one and we'd watch the drum cleaner and go what's he got. Oh, man, that's a big shark. I wonder what it is? And then they'll fiddle around for 10 minutes and drag it out to sea and let it go. You'd be like, should we have closed the beach? I don't know. He was only 500m out, a really big shark, but no one told us. So I don't know. We seen it, but I don't know, they took it out there. Will it be alright? I guess it will be alright. So at work it's a real big pain like that, because there was no communication through the contractor. (CP6)

Professionals with a duty of care said they were concerned that expectations of communication around SMART drumlines (and other strategies as well) needed to be clarified, and systems integrated appropriately among different authorities and stakeholders.

5.3.6 Mitigation preferences

This section reports on participant's stated mitigation preferences after the trial was completed. Much of the discussion focused on popular or patrolled areas, with many stating that unpatrolled beaches required personal assessment of risk.

The main preference was for non-invasive, elevated viewing of the beach, and in-water alerts from either human-operated shark towers or drones. Participants mentioned the environmental benefits and cost saving of drones over helicopters. There was one condition for aerial surveillance: they must come equipped with sirens.

... helicopter that has located the shark, to me they should have a siren or some way of notifying. (CP6)

I'll go for drones. I think drones are really good. If someone comes in and says, I think I've seen a shark, we can put the drone up, go and have a look at it's direct, straight away ... but I think drones are the things that you want to spot sharks with (CP6)

... they are eco-friendly with the drones, but they run on jet fuel. (CP3)

However, they also stated that the timing of helicopters would need to be improved if this approach was to be effective for popular and patrolled beaches.

Not the DPI helicopter in the morning that goes across before we get to work and then comes back while we're at work, and then goes across and we're alright, we're good for 10 minutes, I reckon. (CP6)

The current difficulties concerning alerting people in the water led some participants to suggest this should be a priority when selecting and designing approaches. Nearly all users echoed this sentiment.

But I like that idea of having a siren attached to it as well, if it's going to be useful to relay an app to people who are at home in bed listening to the ding, why isn't it useful for someone who is out there in the vicinity of where the shark or other marine animal might be? (CP8)

Is the technology there to ping from one to the other and send it through on a single 4G outlet? I mean, they do ping from one to a transducer, that's where they upload the information, so surely they could ping from one to the other. You could have a multiple amount, surely. (CP3)

Participants said they did not support nets. They said they preferred newer technologies and having sirens/flashing lights on existing measures (eg listening stations and SMART drumlines), to warn of sharks present.

I am dead against shark, dead against the nets. I don't think we should be using nets as a management tool. I think that they're wrong. I think given the amount of technology that we do have out there today, we could perhaps be better served investigating those lines of inquiry as opposed to the SMART drumlines. (CP7)

Utilising modern technologies can definitely enhance it from where it is. So, I think we've got a good start... we don't want to rest on our laurels. We are definitely a lot better than we were five, 10, 20 years ago, but let's just keep striving to improve it. (CP8)

Loud noises, sirens. (CP5+ CP6 + CP8)

There was a strong and unmistakable push by lifeguards and those who patrolled for an integrated and coordinated system.

So, at work it's a real big pain [poor communication], because there was no communication through the contractors [aerial and listening stations]. (CP6)

DPI needs to invest time and have more input into what local government should be doing with these listening stations that they've put in, instead of them just dumping them onto us to react ... They [official shark observer] sit ... and watch

for the sharks. That's all they do. They're not allowed to save people, they watch the sharks. (CP6)

There was an expectation that the DPI would help local governments with guidelines and models, and that systems would ensure human oversight is maintained. In short, they trusted humans ahead of technologies to keep people safe.

5.4 Forster-Tuncurry

Table 4: Forster-Tuncurry main attitude findings

Main attitude findings
<ul style="list-style-type: none"> • Overall, shark risk management needs were considered low, but some mitigation need perceived to deal with white and bull sharks • Surfers saw no value in the mitigation measures currently available • General acceptance of SMART drumlines (for research), but hope that technology will find more efficient and less invasive ways of tagging • Low awareness of SMART drumlines as a mitigation strategy • Some participants assume that swimming in water near SMART drumlines is hazardous • Drone surveillance and sound (siren, etc.) alerts preferred (helicopters considered too sporadic) • Community rely on lifeguards and lifesavers for shark information; communication needs to focus on those with a duty of care • App/listening station criticised because ‘not all sharks can be tagged’ • App criticised for lack of specific/local information • App perceived to generate fear and reduce beach usage ‘irrationally’

5.4.1 Perceived shark mitigation needs of region

This section reports attitudes and thinking towards the shark mitigation needs of Tuncurry - Forster. There was a clear expression of need, with many participants indicating this need has arisen during and after the trial, and notable increases in shark sightings and detections.

I must admit with the number of the sharks detected with the listening device and more of them have been detected with the helicopter patrols, we've had to shut the beach a couple of times, and that we've for a short time changed our pattern of where we swim sometimes. We don't go as far from shore as we used to. (FP5)

There was a perception that there is an increased need for mitigation because of increasing Great White and Bull Shark numbers. These two shark species elicited fear among participants.

The problem really appears to be, from our point of view, is that there are a lot of White Pointers, and Bull Sharks would be the next one behind them. Probably on a scale, the Bull Sharks are a lot worse than the White Pointer. But their population is increasing at a great rate with basically no control, getting up in the back of the lakes and up the rivers and that, they're becoming a huge problem. (FP4)

However, others in the group did clarify that many of the sharks spotted were 'good' sharks, that did not pose a threat and actually have now become local celebrities.

When you talk about Grey Nurses and stuff like that, it's not the problem. (FP4)
.. actually, over the years and over the time we've just gone, oh, it's just a Grey Nurse. (FP9)

It's interesting with the Grey Nurse Shark population in the area that, I think to begin with, a lot of swimmers were a bit wary of the Grey Nurse and now they've come to endear it and we call them Fluffy! (FP9)

Mitigation needs were also influenced by the activities undertaken. Divers, for example, saw no need for mitigation, while surfers were mixed on need for mitigation.

I was asking my son, actually, his perception and the perception of their cohorts in preparation to coming tonight, and I think they say well, when we're surfing we don't really want to see one because we're seeing it from above. We are just seeing a fin. But when we're diving we really want to see them, so it depends where you are coming from. (FP9)

But, yeah, to be honest, I really don't think we have a problem here. (FP1)

5.4.2 Perceived value of listening stations and SharkSmart App

This section reports on attitudes towards and thoughts on the value of listening stations and the SharkSmart App in the Tuncurry to Forster region. In short, participants indicated that both the app and listening stations serve a purpose for professionals. This information thus

benefits the community through the professionals. Surfers, however, stated that because they move around a lot, the technologies do not impact their safety.

Alignment with local context

There was strong agreement that beach authorities in charge of community safety should be well informed about sharks. They have a moral obligation and a duty of care. Many in the group agreed that both sets of technologies were useful for beach authorities, and have the potential to save lives. However, they are not feasible for unpatrolled areas. There was special mention that tourists do not directly rely on communication technologies, rather, they use the lifesavers for information.

Yes, for a patrol, we've got a duty of care to keep the public safe. (FP7)

From that point of view, it would be handy near patrol areas. I mean, you can't surveil every beach and every part of the coast. (FP2)

I think they rely on us, the tourists rely on the surf lifesaver patrollers, and they might come up and say were there any sharks today? I've had a couple of people say that. (FP1)

There was consensus among participants that personal risk is unavoidable regardless of the range of mitigation strategies used. While supportive for other users, surfers saw no need for the devices in the area.

You are responsible for yourself. I feel you can't sue the council or make somebody responsible for when you go into the ocean. Basically, that's as simple as that. You swim at your own risk. (FP8)

Yeah, I think it's a great idea that people know what is going on and it's up to them to make the decision whether they want to go for a swim or not, or a surf or a paddle or go fishing. The onus is back on them, isn't it? They're responsible for themselves. (FP3)

My thought is, you enter at your own risk. (FP9)

Oh, there's definitely a role. But from a surfing point of view, I think probably unless you download the app and put it in your phone, that could be an advantage. I don't know whether it would change our minds or not. It's hard to imagine, eh? I don't think it would. (FP4)

But like (FP7) said, if you're surfing somewhere remote, it's not going to have any benefit for you at all. (FP6)

Likes and Dislikes

Participants were enthusiastic about the technologies for research purposes and saw potential to improve our understanding of shark habits and behaviours.

Not only just using the beach, but also for the DPI to see the movements of the sharks. (FP8)

However, a perceived delay in information processing, making it undependable, was seen as a negative for those who choose to use the app. Another risk mitigation shortcoming many participants noted was that the listening station and the app provide minimal protection while just a small number of sharks have been tagged.

So that delay is so extreme that it is quite pointless. (FP4)

I'm of the opinion that there's probably like one percent of the sharks tagged in the ocean. Not even one percent ... So every time that thing pings, there's probably a hundred sharks swim past it. (FP6)

Participants referred to non-specific information from the app (in the form of multiple alerts, sometimes from just one shark) as a negative that can cause hysteria unnecessarily.

My daughter is a surfer and a lot of her friends ... went nuts over it, it was driving them crazy because there were so many sightings and all of that sort of thing along the coast. But um, yeah, I think it added more hysteria instead of usable knowledge about where you wanted to go. (FP7)

.. more specific to certain organisations [lifesavers], so there is no hysteria. (FP8)

Influence on behaviour

Participants perceived that the information relayed by the listening station was irrationally changing behaviour among more anxious members of the community. Decisions were being made to visit the area or enter the water based on fear rather than useful information.

If they hear of an incident at the weekend, then the next Wednesday or the last couple of days, they go, oh, we won't go out, we won't swim out to the listening device we'll just do ins and outs and do just a shore swim. (FP1)

Importantly, the app had stopped some people going in the water, sometimes resulting in choosing other activities.

Um, it's a double edged sword. Yeah, I think the public do need to know. The public has reacted to the pings. When I do the snorkelling for the high school kids, if it goes off, they don't get in the water. So that's a disadvantage, because I don't know if they say it's a Grey Nurse ping or it's a white or a Wobbe[gong] or whatever. So, it's just a shark with teeth. So, yeah, that's a bit of a disadvantage or a drawback in the system. (FP2)

They get it straight up. Oh, geez, I won't take [child's name] out for a swim today. There's a shark out there. We'll go tomorrow. Let's go bowling. (FP3)

Most surfers indicated they never used the application. However, for those participants who did download the application, it was used for a brief period of time, then abandoned. The fear it elicited resulted in people turning the app off.

I've never used it. Yeah, I've just never used it. (FP5 + FP4)

Yes, well whenever those things ping, and a lot of us have had that shark app and we've had to turn it off over the years because we go, oh, the whole time. (FP9)

I'm all for the research part of it, but I don't think the public needs to have access every time it goes off. As far as I'm concerned, it is just creating hysteria in the community. (FP6)

Some did say they use it not for safety reasons, but to follow sharks, as they found the animals interesting. This group did state that the frequency of alerts through devices could have negative effects on family relationships.

Yes, I was an avid SharkSmart watcher when it first came out. Not for safety, but I was more intrigued about finding out about just so little that we know about sharks. I ended up deleting it before I got divorced, because it was going off at all hours through the night, much to my wife's disgust! (FP6)

5.4.3 Implementation concerns with listening stations and apps

The major concern for people was the poor capacity to inform users effectively. People essentially had to be on land, with technology in hand for it to play an active role in decision making.

Like I said, it's [of] no value, it's very little value to us in this beach when the next one is alerted. So, when we get the information from the DPI helicopter which can be useful, perhaps. I mean, we still rely on being vigilant. (Fp7)

Participants said they were also concerned with the level of specificity in the data, as it did not take into consideration patterns sharks exhibit, or discern the number of sharks, which could be causing unnecessary hysteria.

I think by the time that signal goes to the satellite and comes back down, people have already been in the water for such a time factor, from when it did actually pick up something. So, whether it's still in the area or not, that's debatable. Especially with White Pointers, um, some sharks will hang around, but White Pointers will cover so much distance at any given time, they will cover a lot of territory. (FP4)

And then you'd go, oh, it looks like there's ... and then you hear this ping, ping, ping. You'd go, oh, is it five different sharks, or is it the same shark getting picked up? ... Yes, or going around, saying, ooh, I'm going to go around again. That was cool. So, I think there was a bit of hysteria. Oh, there must be lots of sharks out there, where there could just be one shark going, oh, I might do a couple of laps here. (FP1)

Some participants advocated the need for more listening stations (20 was considered too limited), and integration with other detectors, especially if the DPI wanted the technology to be effective as a shark mitigation measure.

I think it's fairly limited. Um, but there are other, you know, I think there needs to be more than those if it's going to be effective, in terms of giving a heads up about sharks around. (FP7)

... keeping the listening device and perhaps marrying it up with another type of device a little bit further along. Not only just Forster, there's other beaches as well. As you said, there were 20, wasn't there? (FP8)

5.4.4 Perceived value of SMART drumlines

This section reports attitudes and thinking concerning the value of SMART drumlines.

Alignment with local context

The prevailing attitude in the group was that despite very high use of the coastal waters in the region there have been few incidents with sharks, and that management of sharks is generally adequate.

However, the group said that the high amount of water use means some management is required, especially on patrolled beaches. They felt that surfers who are most at risk from sharks are mobile, and it is difficult to locate immobile shark mitigation such as SMART drumlines appropriately to surfers' advantage. Further, it is not feasible to locate SMART drumlines at all locations year round.

Most of the group said they felt that catching sharks was unnecessary to protect humans, but they recognised value in tagging for data. Catch and release was definitely preferred. They were not in favour of lethal catches or harming sharks.

The group were very supportive of gathering data about shark movements and behaviour patterns.

So, well, it's a means of collecting scientific data, I think. That's good, I know that setting up programs to collect data is sometimes quite difficult, so if it achieves that, then they've got a lot of data for along the coast ... (FP1)

They had a resigned acceptance of SMART drumlines insofar as they support tagging to find out more about sharks, but they would prefer tagging that was less invasive to the sharks, and more resource efficient.

Like I say, the only thing I think they've got going for them is the data that they provide. If there's another way that it can be gathered, I think it would be better. (FP6)

Attitudes to SMART drumlines were multidimensional and ambivalent in this group. There was acceptance of a need for management of sharks and gathering data. But, participants expressed apprehension about risk to marine life and the potential to create fear unnecessarily, or in ways that harm the local economy.

Likes and Dislikes

There was general acceptance of SMART drumlines, but most accepted with reluctance. They perceived a need to learn more about sharks and they support tagging sharks for research.

So, well, it's a means of collecting scientific data, I think. That's good, I know that setting up programs to collect data is sometimes quite difficult, so if it achieves that, then they've got a lot of data for along the coast ... (FP1)

However, most said they would prefer a different way to tag sharks.

Like I say, the only thing I think they've got going for them is the data that they provide. If there's another way that it can be gathered, I think it would be better. (FP6)

There was concern that SMART drumlines may cause harm to sharks that are tagged.

I'm just more concerned that the shark's not hurt, if it's caught, and that it's not injured, because they're protected and I believe that we should protect a lot of species of shark. (FP8)

There were mixed feelings about bycatch. Some feel the advantage of SMART drumlines was that they avoid the bycatch associated with mesh nets.

I agree that data is very important. It's better than the alternative as in netting. If you target the shark, you're pretty much going to catch a shark. You're not going to kill a turtle in a net or a dolphin or any other marine life. Um, and there's got to be some method of getting the data, and I think that's the least damaging to the shark to get the data. (FP3)

But other participants said they were concerned that SMART drumlines will catch non-target sharks and other species. Some had read about SMART drumlines killing Hammerhead Sharks.

So, from what I read about this, the Hammerheads, and I don't know how true it is, but I signed a petition saying we don't want these now on the change.org about the Scalloped Head Hammerhead Sharks that were getting caught and getting killed as a result of the SMART drumlines. So, that's not good. So, I'm concerned about the health and wellbeing of the sharks. (FP1)

I don't really like them. Maybe for the data if ... they're not really too smart because they just catch whatever is swimming by. If they could control the species that they're targeting, then, yeah, go for it. But, just to catch everything that swims by, I'm not real keen on that. (FP2)

Others are troubled by uncertainty about what happens after tagged sharks are released.

Well, I don't believe in nets. I can't see that something that is supposed to mitigate a shark problem that does so much damage to other species, it's a pointless exercise. The drumlines, I'm sort of 50-50 on those at the moment. If it's tagged and released, and if as they say it discourages a shark from coming back to that area, I don't know how long that might last. (FP2)

I think, um, if that's the only way you can get to them to tag them, it's a bit of a concern, but I mean, I think tagging and research is a worthwhile thing to do. I'm not sure that the premise that a tagged shark with the experience will not come

back to the area for a while. I don't know how you test that until they're caught again. Um, and as I said, we are only talking about small numbers. (FP7)

The group said they liked the idea of data from tagged sharks increasing our understanding, but questioned the bycatch and shark distress they associate with SMART drumlines.

Influence on behaviour

The prevailing attitude was that SMART drumlines did not influence group member's behaviour in the water.

It didn't change what we were doing, no. It had no effect at all. (FP4)

When asked if SMART drumlines affected their use of the water, some participants assumed that swimming in the water near the SMART drumlines was hazardous. However, the water by the shore 500 metres away is perceived to be safe.

Well, I can't say I like much about them, really. In terms of going in the water, that doesn't concern me. They're a long way out. So 500 metres, whatever happens 500 off the beach is not going to affect our swimmers 20 or 30 metres off the beach, necessarily. (FP7)

I'm not a big fan of them either. I think the only thing that the drumlines have got going for them is the data that they provide the DPI. Um, they haven't affected my water use at all, and I'm sort of not concerned. (FP6)

I don't have a problem entering the water whether they're there or not, and if they are operating, it doesn't bother me, you know? I'm just more concerned that the shark's not hurt, if it's caught, and that it's not injured, because they're protected and I believe that we should protect a lot of species of shark. (FP8)

In evaluating SMART drumlines, most participants were less focused on short term risk mitigation for humans than on the wellbeing of marine life. They reported little influence on their behaviours or attitudes towards the water.

5.4.5 Implementation concerns of SMART drumlines

One member of the group said he believed that contractors faced a challenge getting from alert to the shark in 20 minutes, and collecting all the necessary data.

[The contractor] reckoned it was an absolute nightmare for all the data he had to get. It wouldn't have hurt the shark. It is just the way that they had to handle it. And the response time, from the moment, he only had 20 minutes from the moment he ... The contractor, from when he got the signal, they had 20 minutes to be on the site at the shark. The way that he can keep moving his tail, it's only when you tow him backwards he's going to die. Whenever he can keep swimming, don't you believe that? (P2) (FP5)

Otherwise, participants did not raise concerns about the implementation.

5.4.6 Mitigation preferences

This section reports attitudes and thinking towards the shark mitigation needs of the Forster/Tuncurry region, after the completion of the trials. Aerial spotting was the preferred method of mitigation, with helicopters and drones being the most popular. People did say that the infrequency of helicopters influences their preference for drones.

But, I think the best thing is when the helicopter circles and then they've taken out their loud hailer and then actually yelled out, get out. I think that's really effective but it's quite, I mean, everyone's like wow! That's sensational, you know, that's sensational. (FP9)

Drones would be great. (FP1)

I agree with (FP7), if maybe drones for the patrol area anyway, when we're on patrol, just to get a better look at what's going on. (FP6)

And, I also agree that drones would be a great addition to a patrol. (FP9)

But, I really do believe if they wanted to see what was going on, you know, the drone, Cape Hawke would have a drone, Forster would have a drone... And the board riders. Just to move up and down the beach, they are going to get more effect and more benefit out of that than anything we've all been doing. (FP5)

Sounds (eg shark alarms on the beach and helicopters) were also a popular option for the capacity to be immediately alerted. Some made reference to a clever buoy style detection system being preferred to sporadic aerial patrols or SMART drumlines (or the destructive nature of nets).

If it's for patrolling, I'd rather have something like a stationary beacon or something like that in the water that would pick up something over a certain size, so that we can be alerted that there's something in the area that's fairly big ... That to me would be a more useful thing than a drumline 500 metres off the beach or a helicopter going over twice in, you know, in an eight-hour patrol day, or something like that. (FP7)

Well, I don't believe in nets. I can't see that something that is supposed to mitigate a shark problem that does so much damage to other species, it's a pointless exercise. (FP2)

That being said, surfers said they saw little value in any mitigation measure and stated nothing was useful for them because of the nomadic nature of their ocean lifestyle choice.

Well, look if you're a swimmer, the beacon is the best option. But from a surfing point of view, there isn't any advantage for us at all, really. It's more of a word of mouth thing because we are all moving around so much and we are in so many different spots and that, so it is going to be somebody else that has spotted one that has said something and that's the way it goes. (FP4)

5.5 Kiama – Shell Cove

Table 5: Kiama to Shell Cove main attitude findings

Main attitude findings
<ul style="list-style-type: none"> • Low risk area, but trial attention justified by region’s large [human] population and reliance on tourism • Current mitigation mix supported, drones expected to dominate future of shark risk mitigation • Low awareness of SMART drumlines as a mitigation strategy • Nets opposed due to bycatch, SMART drumlines preferred for being less invasive • SMART drumlines liked for research that helps future-proof the region • Human oversight considered integral to correct response to alerts and other information • Communication systems with lifeguards need to be improved • SMART drumlines and SharkSmart App/VR4G perceived to be important due to large [human] populations using water • SMART drumlines and SharkSmart App/VR4G valued for reassuring tourists

5.5.1 Perceived shark mitigation needs of region

This section reports attitudes and thinking towards the perceived shark mitigation needs between Kiama and Shell Cove. There was a strong tourism and economic discourse used to justify the need for shark mitigation in the region.

We really need to maximise, to have vibrant communities on the South Coast. We need to have big populations of people visiting here for their big four-week holiday and we need them to feel safe. So, I think that if the public perception is that busy locations like Kiama or Jervis Bay or around Mollymook, for instance, if the public perception is that we have all this technology out there that is helping keep us safe from sharks and therefore people will come here for holidays and therefore feel comfortable, that’s a good thing. (KP1)

We have more people, so we might get more bang for the buck for tourism or overall economy point of view. Yes. (KP8)

Specific instances were mentioned that may require mitigation assistance. These typically revolved around times of increased fish activity, sunrise and sunset and around river mouths.

Sometimes, if it's late in the afternoon and it's sometimes coming on dark, that's the time when sharks are likely to be active. Certainly, near the river mouth, everyone knows river mouths, you know, at certain times of year when there's bait fish, and things like that. If you're by yourself surfing and there's no one else, that's not safe. (KP5)

However, overall there was little sentiment among participants that mitigation was needed beyond patrolled and popular beaches.

5.5.2 Perceived value of listening stations and SharkSmart App

This section reports on attitudes towards and thoughts on the value of listening stations and the SharkSmart App in the Kiama to Shell Cove region. In short, participants indicated that both the app and listening stations served a purpose for professionals (eg lifeguards), with the community benefiting indirectly from the information. However, there was some concern that we should not over rely on technology, that beach education and personal responsibility were very important dimensions of safety.

Alignment with local context

The group saw a need for the SharkSmart App and the listening station, particularly for beach safety.

If it saves a life, definitely. (KP2)

.. things like Nippers here at this beach, you know, there would be some recent shark activity at the beaches around here, so I think it's good to know as a parent that all the checks are in place for the surf lifesavers and the Nipper crew to look after the kids in the water. (KP5)

I definitely think there's a role for it, particularly if providing information to the surf lifesaving clubs. (KP6)

... if we receive a notification, then that patrol is able to place a higher vigil on watching the water and even out past the break for any activity or things like that.

So, I think like was said earlier, information is valuable so that then you can put your procedures and things in place to try and mitigate any risk to the swimmers on the beach. (KP9)

However, for surfers there was no point as the capacity of the technology was limited to helping those on land with a device at hand.

It's not like we take our phones in the water. (KP7)

Participants said the app and listening station do little to mitigate risk of harm from sharks. The use of apps and listening stations needed to be complemented by other measures to increase effectiveness and community safety.

They've got IRB's out there and beacons out there. There's a lot of safety protocols that go on, and having an extra level of awareness is good from my point of view as a parent with young kids in the water and big groups. (KP5)

Because some community members' anxiety towards using beach and ocean was due to sharks, some participants said information could lift those barriers.

I think it's great that we have access there if we need to know, if we're feeling really worried and cautious and we want to find out, we can access that to reassure ourselves. But, yeah, I'd prefer not to know and I think the ocean is something that we should really respect and we take it for granted. (KP2)

Likes and Dislikes

Most participants said they liked the idea of being informed.

All information is good information! (KP2)

Participants agreed the listening stations were good for research and future proofing, ensuring information could be used at a later date if needed.

No matter how unscientific it is, providing some sort of data where previously you are going to get criticized for not taking the situation seriously. So, I think that they do need to do something and authorities do need to get that on, because the first thing that happens when more sharks turn up or there's a spike in attacks or something is that we need data. That's what everyone calls for. We need scientific evidence. We need data. (KP1).

I think it is probably more beneficial in terms of a data gathering exercise, as long as the scientists involved are designing their experiments around the types of sharks that people actually want to get information on. Especially if not much is known about sharks and all the ones that are most likely to have adverse reactions with people, and the more data they have on that, then someone getting that data over a number of years and analysing it and reporting on it, it's obviously going to provide valuable information about shark movements along the coast. Even the data that is there now, it will give them something to build upon. (KP6)

Participants also prized cohabitation with sharks, stating the information that technologies gave would be useful for balancing needs of sharks and humans.

Yes, absolutely. I have a healthy respect for a healthy marine ecosystem, so there's obviously that balance between how do we make the public aware and the value of that awareness to different individuals with different relationships with the ocean. (KP4)

However, there was negative sentiment about the delay of information between the listening station and the app.

Yeah, it went off during Nippers one time this year. And nothing happened. By the time it got back to the people on the beach it was already over. So that just showed the delay of who got the information and when it came through. The people on the beach running the Nippers had no idea. (KP8)

It was also said that the VR4G was limited to the number of tagged sharks.

I think until everything in the sea is tagged, it is a bit, you know, it is not going to be a failsafe thing. (KP7)

Influence on behaviour

Many said it did not impact their behaviour because of their choice not to use the app; but it did depend of the individual's threshold of fear.

No, not at all, I still go in every time. I still swim and do what I want to do. (KP8)

... it doesn't really phase me personally. Um, but I know other members of our patrol are quite tentative around any notification of anything being within 500

metres of where they want to swim. So, definitely different people have different thresholds on how they want to expose themselves to the water, I guess. (KP9)

There was a group of participants who said they preferred not to know, as they felt it distracted from why they use the ocean.

I surf and swim for pleasure and relaxation. It's kind of like the same reason I do yoga and stuff like that, and I absolutely do not want and hope that I never seek information about shark presence out there because I don't need another level of communication. I have a busy life in terms of communication anyway. (KP9)

However, the low levels of use were compensated by active word of mouth.

... if people have seen that same shark can come in, it's generally people who are checking the spot to go out. People will hang around and tell people. (KP1)

It's actually very true. Most of the reports we receive are ground level. (KP8)

Interestingly, some use the app to try and find sharks.

... if it says Grey Nurse at Bombo, I would think cool, I'll get on my paddle board and get down and have a look. (KP5)

5.5.3 Implementation concerns with listening stations and apps

Poor communication was highlighted. Lifeguards in particular disliked the lack of coordination between the DPI and beach authorities, and lifeguards were also concerned about the technology directly contacting them.

Because when it goes off, we only know from our work roles that it doesn't contact us directly in any professional way. It's just an individual basis ... It's through the app. We don't get called on our radio from Surf.com saying you've just had an alarm go off. (KP8)

From the perspective of awareness, some participants mentioned they were not aware of either technology, with more stating they had no idea about the VR4G and its positioning in the water.

I didn't even realise what it was for. I've seen it out there for years and I never knew. So it's interesting to find out the information you're getting from it. (KP4)

Participants also stated that over informing could impact perception of sharks, exaggerating their number and/or risk among the community. Because the information does not discriminate for ocean user type, the users can receive inappropriate amounts and types of information.

It's got to be that balance between someone who doesn't interact with the ocean at all and gets three messages in a week versus a fisherman who sees three a day and doesn't care ... the knowing versus the crap. (KP8)

Previously, you just knew they were out there and had no idea how many people had seen them, and then all of a sudden everyone is reporting everything and there could be a perception that there's more sharks around. (KP1)

It may seem like someone in the general public thinks there's more, and they've been told about three, when previously people may have seen that and had no warning. (KP8)

There is also a procedural and reputation risk of not sharing data, now that people have become accustomed to having it.

If you put it out there, and then if people want to use it, they use it. But if you run the risk of collecting the information and don't share it, people are going to say that ... is there some reason why you're not sharing it? (KP1)

5.5.4 Perceived value of SMART drumlines

This section reports attitudes and thinking concerning the value of SMART drumlines.

Alignment with local context

A non-fatal shark incident at Bombo in 2016 is entrenched in local awareness and perceptions of risk, but the prevailing attitude of the Kiama-Shell Cove group was that their waters are largely free from shark danger.

They supported using SMART drumlines and other shark harm mitigation strategies, justifying them with reference to large numbers of people entering the region's waters and the region's dependence on tourism.

So, I think that if the public perception is that busy locations like Kiama or Jervis Bay or around Mollymook, for instance, if the public perception is that we have all this technology out there that is helping keep us safe from sharks and therefore people will come here for holidays and therefore feel comfortable, that's a good thing. So, I support all of this technology, but in focused areas. (KP1)

They were opposed to the use of mesh nets because of bycatch, but most approved of SMART drumlines. They tended to value SMART drumlines as tools for tagging and research that might be useful if shark encounters increase in future.

I think we're doing alright, but again, in terms of you never know what's going to come down the track. We might end up with a cluster like Ballina at some stage, so keeping the ball rolling so that you're on the front foot in terms of data and research before something happens and they are playing catch up. Stay proactive in trying to answer questions with data is probably positive way to go. I don't think we need active shark management, though, because it's just really a passive playing around and collecting data. (KP6)

My first thought was, I wouldn't care if they took away, like decreased, the shark management program. But then I thought, how do we increase our knowledge of them and awareness? We need these measures in place if we want to find out about them and how we can manage it, I suppose. So, for my own safety, I wouldn't care if they took them away, but I think we need them there to create knowledge and awareness about how they behave. (KP2)

Several group members noted that SMART drumlines could never tag all sharks, that there could not be enough to cover the coast of NSW, and that the ocean would always be a place of risk. There was low awareness of SMART drumlines as a risk mitigation strategy. They were not valued as a way to make the waters safer now.

I didn't view it as a way to keep the kids safe, because they may or may not eat the bait. Yeah, it wasn't about protection, it was just about, for me, I saw it as you've got to start tagging sharks. (KP4)

I don't think ... will they be effective? Well, it's not for safety, is it? (KP3)

I don't think it's much use for safety, for swimming, but I think as long as we're tagging them and collecting knowledge about species and how we can protect them, then yes, they're useful. (KP4)

In summary, the group supported SMART drumlines and tagging sharks for the data they provide to improve understanding of sharks.

They were also opposed to harming sharks and other marine life. If they were to associate SMART drumlines with harm to sharks their support could quickly disappear.

Likes and Dislikes

Overwhelmingly, the group said they liked the SMART drumlines for their tagging and contribution to understanding about shark populations, movements and behaviours.

I agree a lot with what (KP6) said about information being used by the primary industries and sciences for their research, definitely, in terms of movements of sharks along the coast and ocean temperatures and all the things that come into play as we see the shift and change of marine habitats. (KP5)

For the listening station to be of any value, you've got to have more tagged sharks. So, I support them and I think the more of them, the better, I guess. We all kind of generally agreed that the listening station was a good thing, which I also support. So, I'm supportive of the SMART drumlines. (KP1)

Importantly, research is also valued for protecting the sharks.

We know where they like to swim and then we can make an assessment and say, let's let them swim there and we can go somewhere else or pick a new day to swim. That's how I see it, yeah. But, if they're there first, we have the awareness to stay out of the ocean. (KP2)

A valued feature of SMART drumlines is that they catch and release sharks, they are not lethal. Some compare them favourably with mesh nets.

So, yeah, in terms of a way of adding more sharks that are tagged, or the tagged amount of sharks, I guess I prefer that over any sort of netting type activities. (KP5)

Yeah, it's a non-lethal approach. I think that sharks move offshore once they've been caught on a drumline, so they're far more effective than nets, I reckon. (KP6)

On the proviso that they don't harm animals, one participant saw multiple benefits from SMART drumlines.

... I think they're probably a good idea. You know, minimal casualties, for data collection, yeah, more tagged sharks and all of that. I can't really see the negative, only if there's casualties. But, other than that, look at it this way. You're employing people. People are going out there to do it and they're getting paid to do it, you know? Look at that, creating jobs, why not? So, I don't have anything negative about it, it's all positive. Yeah. (KP4)

Participants said they felt there were unanswered questions about what happens after sharks are released, and some group members were unsure if SMART drumlines would actually attract sharks.

Yeah, you were saying that sharks tend to swim away, so I thought about the research, I was wondering if they get caught and just come back. (KP5)

I would be really interested to see, you can't tell what sharks think, but if it does attract them more. (KP2)

Although not unanimous, overall the group liked SMART drumlines for a range of reasons.

Influence on behaviour

Participants were inclined to state that SMART drumlines had not and would not influence their own behaviours or attitudes to going in the water.

One day there was a sign up on the beach here and I thought, oh, that's pretty cool, and then ... But it didn't change my behaviour. (KP7)

I've swum around it and floated on it, so I do not care about swimming around it. I jumped in and had a look at it when I first saw it. I think the idea is good that it is not killing it and releasing it. Yeah, I don't mind that. If that killed them, I would be opposed to it. For research purposes, when I see the boat go out straight away, I think, oh well, they'll tag it and release it. That's fine. (KP8)

I mean, I have no objection to them. They won't change my behaviour. (KP1)

However, there was some indication that the presence of SMART drumlines could influence tourist visits. As one of a range of risk mitigation strategies, SMART drumlines can help to promote the area as a safe destination for tourists, and that this perception of safety is a worthwhile outcome.

... if the public perception is that we have all this technology out there that is helping keep us safe from sharks and therefore people will come here for holidays and therefore feel comfortable, that's a good thing. So, I support all of this technology, but in focused areas, not all the way up and down the coast. (KP1)

5.5.5 Implementation concerns of SMART drumlines

There were some concerns about the implementation of SMART drumlines. Some felt that the SMART drumlines response time targets are not achievable, due to the long distances they need to cover.

Obviously, it's still going to have some limitations in terms of contractors who have 10 minutes or 15 minutes, I think, of being able to access the buoys so it's still going to have its limitations up and down the coast. (KP6)

Some were troubled by the notion of subcontracting the response and retrieval work, and wondered if adequate oversight was occurring.

Well, the people handling them. It's what it comes down to. When you subcontract out something, you've got no ... well, you've got a certain amount of control over how you want it to happen. It's just a management issue for the people participating in the program. (KP6)

At least one participant was very sceptical about the accountability of the implementation and its reporting.

The government, or whoever is doing this, I don't believe that they're not harming animals. I think you don't always hear the truth about things like this. But they've got to have it, I suppose. (KP3)

Others were concerned about subcontracting such work to private operators, especially those who are not 'scientists'. Irrespective of oversight and accountability processes, they said that contractors may be motivated to cut corners on animal welfare and reports.

Yeah, I think I would rather that, yeah, I don't want to say anything bad about the contractor, but I would probably prefer that they didn't contract it and that they managed it themselves. I know the guy doing it used to be a charter boat guy and he's like, why would I do that? This is heaps easier. Now, like it's true. He runs it out, he checks his thing, he goes and gets one if it goes off. It's easier, you don't have to deal with customers, don't have to deal with bookings and you've got regular work. But these other issues can come in and you've got, what, how many different contractors up and down the coast? Do they do things differently? (KP9)

Different vessels, different crews. You'd be probably better off to run them in-house. It might cost more, but then your output is probably better from a scientific point of view. (KP9)

They recommended that the program be implemented in-house by public authorities to enhance trust in the program's treatment of marine animals and data accuracy.

5.5.6 Mitigation preferences

This section reports preferences for shark mitigation in the Kiama region. Overall, there was strong support for aerial surveillance (eg helicopters, planes, and the strongest support for drones), with no support for nets because of the increased bycatch.

Yeah, I think the aerial, and drones definitely give you a good visual point because they cover more area and you actually see better, except from just looking from out here. Definitely, yeah. (KP4)

I'm not a fan of the nets, the netting of sharks because of too much bycatch of other marine creatures who get caught up in the nets. (KP8)

They also catch a lot of other marine life, so that's why I'm against nets. (KP3)

There was robust support for being proactive with research, for the future.

We might end up with a cluster like Ballina at some stage, so keeping the ball rolling so that you're on the front foot in terms of data and research before something happens and they are playing catch up. Stay proactive in trying to answer questions with data is probably a positive way to go. I don't think we need active shark management, though, because it's just really a passive playing around and collecting data. (KP6)

Overall, participants said they were happy with the current mix of alerts: SMART drumlines, drones and alerts in the form of sounds, and several projects in the area.

... we should be lucky that we've been given, there's been a project to monitor sharks and there's been another research project over here where they did drones every day. You know, then we've got this other research project happening. So from Kiama's point of view, we couldn't whinge about what's been put in place, it's probably better than other areas. (KP8)

Participants said that research was needed, not just on sharks, but on how humans use the information to impact behaviour. If humans know where sharks are and when, humans can avoid those places at those times and avoid interactions with sharks.

If there's activity, we probably need to see in coming years how people actually use the information. (KP3)

While generally happy, some participants implicitly suggested that more was needed to coordinate and integrate efforts across contractors, aerial patrol and alert systems. There was also some agreement on a preference for humans rather than technology making the important decisions. Some said that technology may cloud decision making, and that they prefer to rely on their own assessment and judgement.

I'll make assessments based on conditions and things like that, whether I'll go in or not ... I just don't need more clutter in my brain. (KP9)

I choose not to receive the tweets or get the app, because I'd rather make an assessment myself on conditions and safety that way. (KP7)

5.6 Ulladulla to Narrawallee

Table 6: Ulladulla to Narrawallee main attitude findings

Main attitude findings
<ul style="list-style-type: none"> • Ulladulla questioned as a site for SMART drumlines trials – locals consider shark management needs to be minimal • Low awareness of SMART drumlines as a mitigation strategy • Locals consider it's now important to manage shark fear among tourists and potential visitors • Perceived failure by authorities to consult appropriately with community to locate trial in an area of need • SharkSmart App/VR4G valued for beach management • SharkSmart App of little use to general public • SMART drumlines considered cruel to sharks, also concerned by rumours of shark cruelty during handling • Lack of trust in SMART drumlines official catch and handling figures • Some local surfers avoid SMART drumlines because believed to attract sharks • Drones are the preferred mitigation strategy • Alerts and other information are most effective with experienced human oversight

5.6.1 Perceived shark mitigation needs of region

This section reports on the perceived shark mitigation needs of the Narrawallee to Ulladulla region. In short, there was strong participant sentiment indicating that there is no need for mitigation in the region.

But no, it honestly does bother me. I'm very respectful of the ocean, and as I said the conditions will keep me out of it more so than thinking that there's a shark or something. It's an irrational fear to me, almost. (UP4)

... as I said, I don't come from this environment. I was 35 years old before I moved to an ocean, and I thought that I would be afraid. But I don't have any fear of the sharks and my family, my children. Zero. (UP6)

I mean, we live in an area where we have thousands of swimmers entering the water each year and we've never had an unprovoked shark attack. Ever. So no, I don't see them as a problem. I see us interfering with them has created a problem. (UP7)

However, while advocating no need for mitigation, those who had direct contact with the public and tourists did say that alleviating fear was important. It was not clear however, whether the mitigation measures put in place had heightened fears, or if increased consciousness was driven mostly by media (social, traditional and digital) exposure.

There is a lot of fear from children and people who aren't used to going into the ocean all the time. You've just got to be mindful of it and talk them through it, with different ways of trying to alleviate their fear of being out there. (UP2)

It's only really been in the last probably 12 months, since we've had all the sightings up and down the coast that, especially at surf school, the first thing that the kids say when we put the wetsuits on is, are there any sharks out there? And two years ago, they wouldn't have even brought that question up. We get it every lesson, now. (UP4)

Especially all the kids that don't get to go to the beach very often, they come down for summer holidays. I've never explained shark sightings more than I have in the last 12 months, at surf school ... And the internet and all of that, they're watching all of that. (UP4)

It's really in the news, and apps on the phone. (UP5)

5.6.2 Perceived value of listening stations and SharkSmart App

This section reports on attitudes towards and thoughts on the value of listening stations and the SharkSmart App in the Ulladulla to Narrawallee region. In short, participants indicated that both the app and listening station served a purpose for professional beach safety management (eg lifeguards), but provided little direct value and benefit for the general community.

Alignment with local context

There was unanimous agreement that both technologies had a role to play in assisting those managing the beach, because of the capacity to inform quickly and reliably.

When I am working as patrol captain on a beach, when I'm on a jet-ski patrol, which is separate again, I use it as a tool. (UP5)

Um, within the surf club I do, but then my role is just as a patrolling member, so I still rely on people above me to give that information. It actually, when you said that, it just pinged in that you have those people coming down who say are there sharks around, and I'm like, I don't know! (UP4)

Beyond the usefulness for beach authorities there was little support for listening stations or apps, with participants preferring education over unsolicited information.

Not me, no. Definitely not me, because I've had experience with it, and it's often a false alarm, basically a lot of the time. For me, the negatives far outweigh the positives, on so many levels. Keeping people out of the water, creating fear, affecting tourism. Creating hype on the beach. Even as a lifesaver, you know, people coming down asking all these questions, tourists that come down. To me, the benefits definitely don't stand up. (UP7)

No, I think there is a role, and I'm in agreeance with (UP1) and (UP2) and I believe the majority in the room that there needs to be more education of all the local people more so, because they are the ones that are swimming there more often. (UP3)

Likes and Dislikes

Research was a popular reason cited for participants' support of the listening stations. Participants liked the listening station for providing insights into habits and behaviours of sharks travelling along the coastline.

I know for research, maybe, but I don't think that the core of the research is being carried out. Although I probably would hope it would be. (UP7),

I think it's invaluable to study their migratory habits, their travel around Australia. (UP5)

For some, the sight of the listening station, situated just off shore, may help to reduce fear and anxiety.

*The community at the moment see out it there; they get this nice safe feeling.
(UP1)*

However, they saw the app as a double-edged sword, not liking that it has the potential to create fear and anxiety in the community, and create alert-information overload.

I still have a bit of a worry about it because it alerts them to it, and the ones that are scared, are saying, oh, so you have sharks around you, you know? (UP3)

I totally agree with what (P4) just said. Information overload. I don't have any of the apps. I don't want the apps (UP3)

Further, they did not appreciate the limited nature of the listening station, that it is capable of detecting only sharks that have been tagged.

... there's not a lot of information and you talk to people and we've all sort of said it. It's okay as long as you're only bitten by the ones that are tagged, but you know, too bad if you get one that's not tagged. (UP4)

Influence on behaviour

The participants said that the app and listening station had minimal impact on their behaviour, with many saying that beyond a professional setting (eg lifeguards) they did not use the application or listening station. Non-lifeguards often stated they did not use apps to make decisions about entering the water.

Oh, the SharkSmart App. I don't have any of the apps. I'm sorry, I don't. (UP4)

Participants mentioned that the listening station did provide a key marker for ocean swimmers, indicating that no fear was being created by their presence in the water.

I use it for my turning circle for my swims. (UP2)

5.6.3 Implementation concerns for listening stations and apps

There were numerous statements indicating that individuals and the community are unsure of the role of the listening stations.

So, the community don't understand, a lot of the community don't understand what all these things are out in the water. (UP1)

A critical account of the listening stations was they were there only to justify the use of SMART drumlines.

For me, I don't like them, because they are there to justify the tagging system that the DPI has implemented through the SMART drumlines which, if you would ask me about those, I don't like them at all. (UP7)

Participants were also unsure of their position in the water, this was based on the perception of the listening stations as a research tool and not a mitigation measure.

What I am offended by is that it is stuck dead smack in the middle of our beach when it could be anywhere along the beach. So, that research could be done anywhere along the beach, I don't know why they're put dead smack in the middle of a really public swimming area. That could be anywhere, it could be round the corner, it could be anywhere. I think most of the community now, how long have we had that thing for? A couple of years? The community now don't even realise it's there. (UP6)

Participants questioned the accuracy of the listening stations in identifying the number of sharks.

So, how accurate is it, though? (UP3)

It could be the same shark being spotted several times. (UP5)

There were several expressions of support for human oversight, with concern raised about taking decision making out of human hands.

I rely on, you know, people with experience, rather than people sending a false alarm through. (UP3)

5.6.4 Perceived value of SMART drumlines

This section reports attitudes and thinking concerning the value of SMART drumlines.

Alignment with local context

The Ulladulla-Narrawallee group said that their shark management needs were minimal, and asked why their region had been selected for the SMART drumlines trial. They challenged the need for SMART drumlines in their area, because they perceive a history largely free of harm from sharks, and low ongoing risk.

... the biggest question here when those SMART drumlines went in, and that we have still not received any answers on, is why on a zero, unprovoked shark incident beach do we have to have that mitigation? I can understand in areas renowned [for] incidents, and even in that situation again I think it comes back to educating people on, you know, different things that we already know about sharks' behaviours and when not to go in the water. (UP7)

However, there was some agreement that many tourists are fearful of sharks, and are very cautious about entering the water.

You try and distract them and go look, there's never been an attack here. We don't see any sharks because that's their greatest fear. There is a lot of fear from children and people who aren't used to going into the ocean all the time. You've just got to be mindful of it and talk them through it, with different ways of trying to alleviate their fear of being out there. You go to the beach in the middle of summer and you look at all these people out there and yet, they're still scared to go in the water. You think, why? You know, you can't understand it. It's hard to understand. (UP2)

The group suggested that SMART drumlines would not help to alleviate tourist fear of the water. They challenged the need for them in this region, arguing that the location was irrational.

Likes and Dislikes

The Ulladulla-Narrawallee group were very negatively disposed to SMART drumlines. They mentioned a meeting that had been organised locally by community members to discuss reactions to the SMART drumlines.

We had people there from kayaking, we had people from the surf club, we had people from motels, we had surfing groups, we had all sorts of a range of stakeholders there. And apart from one, the majority of the people that were there do not want those drumlines out there. (UP3).

The group repeatedly referred to SMART drumlines as adding to fear of sharks in a couple of ways. The conspicuous presence of SMART drumlines just off shore triggered questions about their role, and acted as a constant reminder of sharks:

It's only really been in the last probably 12 months, since we've had all the sightings up and down the coast that, especially at surf school, the first thing that the kids say when we put the wetsuits on is, is there any sharks out there? And two years ago, they wouldn't have even brought that question up. We get it every lesson, now. And especially when the drumlines went out, because they said, what's that out there? We've seen this boat going out all the time and we have to sort of explain that in a way, what it is and what it's there for. And yeah, the sightings that they've had at Mollymook in the last sort of 12 months, which is hardly any, but they're still making a big issue out of ... Especially all the kids that don't get to go to the beach very often, they come down for summer holidays. I've never explained shark sightings more than I have in the last 12 months at surf school. (UP4)

Some local surfers are very careful to avoid SMART drumlines because they believe that they attract more sharks:

Um, well there's longboarding groups, there's the local board riders. They have been out there and they've spotted a lot of sharks, bigger sharks than ever before, and they strongly believe in their own self that the drumlines are a cause of that ... the mindset and the perceived beliefs of people out there is that they are creating an unnecessary attraction ... if you have a shark caught on a drumline for 20 minutes thrashing about, you know, what effect does that do? (UP7)

One participant said that the right people need to be told about SMART drumlines, including Nipper coaches.

Interesting point, the drumlines were used as a turning buoy for the nippers at six o'clock in the morning without them knowing that they were drumlines. (UP7)

Several participants said that they were opposed to catching sharks by any means and for any purpose, stating that there are alternative ways to tag sharks:

There's so many different things that they can just attach them with and you know, they can track them with. It doesn't have to be such an invasive process. (UP3)

Some were concerned that the SMART drumlines catch other non-target marine life, and that the true numbers were not reported.

But the bycatch is just horrific, the numbers, and the truth of what is actually getting caught by the 10 drumlines, we will never know. We will never know what got caught. What I'm told that got caught and what I've read, because I've actively looked it up on the website, the results of what got caught and what I've been told by multiple sources don't stack up by a long shot, by a long shot. And um, yeah, it's a waste of money. (UP5)

Some participants said they very strongly disliked SMART drumlines for several reasons.

I don't like anything about them. I think they're abhorrent, I think they're immoral, they're unethical. They're unethically conducted, the whole process. From my knowledge, and not pub talk, people at the pub talking and getting knowledge, but knowledge from the beach, people telling me. From my knowledge as a builder with the tradies talking to me at work and telling me what is going on. It says nothing good, there's nothing to like about them. As a surfer and a father, and a local resident at a beach with drumlines, talking to all my mates that I've been surfing with for 30 years, they feel that the drumlines encourage sharks into our areas, into the water. I view them, if I hung a T-bone steak off my front fence, I reckon I'd have a few dogs sniffing around my front yard. (UP5)

I do disagree with the drumlines. Ethically, I find them absolutely horrendous. They put the fear of God in all our tourists. Everybody who steps on our beach goes, oh my God, what's that? And of course, we have to explain to them, hey, there's a buoy out there with a big fish hanging off the end of it, in the hope of catching a shark. And people go, oh, no! It puts the fear of God into people. They are afraid of the drumlines and um, apart from the fear of it, it's just unethical. Look at the picture! (UP6)

SMART drumlines were disliked for reasons integral to their design as well as the perceived unintended consequence of driving fear.

Influence on behaviour

The group felt that SMART drumlines had little influence on attitudes to entering the water. They did not feel safer, if anything they felt that the water might be made more hazardous by the SMART drumlines.

Oh, well, I agree with the others. I don't like the drumlines basically from the stories I have heard about what they do. It doesn't affect me going in and out of the water at all. As I said before, it's all these types of things, the pinger and all of that, it just creates a fear out there. Just more awareness of the fact that there must be a lot of sharks in this area to be doing that. (UP2)

I didn't really know a lot about them until I just saw that diagram, but by looking at the diagram, it doesn't really seem very ethical. And as much as I still have a fear of them, doesn't mean that I want to go out and kill them all because again, you know, it's the ocean and we have to be respectful of that and towards them. So, yeah, I wouldn't change my mind on entering the water whether they were there or not. (UP3)

5.6.5 Implementation concerns of SMART drumlines

There were two main areas of concern relating to implementation. First was what participants perceived to be failure to consult the local community adequately and situate the trial in an area of need. Participants said they considered this wasteful of public resources.

And so, I think we have very low levels, and it's like the government is trying to put it out here of how much they're doing, and it's a waste of money. I think that what we do, patrolling and watching and reacting according to what is happening is all that is needed as opposed to prevention. (UP4)

The prevailing group belief was that the decision to locate the trial in this area must have been done without adequately consulting local experts, especially surf lifesavers.

But, as far as our region is concerned, I think that the money that is being spent on shark mitigation here should be consulted with people like surf lifesaving to find out where that money can be better spent and to hopefully keep our swimmers safe from many different reasons, not just sharks. But I think we need to educate the community on sharks are not the enemy. (UP7)

Participants frequently contemplate other ways that shark mitigation resources could have been better invested. Often they mentioned drones as a more cost-effective strategy.

I just think of the money they spent. I think what sort of drone you could get for that amount of money and how accurate that would be, and visually no one can, you know drones, you can barely see them. You might hear the buzzing, but visually for safety for the beach and to make people feel safe going into the water, I just think there's much better ways of ... but I think the government just wants us to see all of those beacons out there and think that they're trying to make our beaches safe. But half of them wouldn't have a clue, half of them probably wouldn't even swim at a beach, you know? I just think it is ridiculous, I think you could be talking to people who actually understand the ocean and can police the ocean. (UP1)

Participants' second and most powerfully expressed concerns related to processes associated with the catching and release, resulting in shark suffering. They questioned the feasibility of an immediate response to a hooked shark, and the outcomes for the sharks, including the pain of struggling caught on a hook, tagging and release, and their fate after release:

The word immediate removal is not quite true. (UP6)

And also, you know, in capturing them, where are they hooked and how much damage had been done to them? (UP3)

I was going to say, they will probably, none of them will come back because they will all die. (UP1)

There were numerous references to stories circulating locally about cruelty to sharks through implementation of the program, and perceived lack of procedural accountability for those responsible for managing the contract.

Where are the watchdogs over these contractors as to how they actually handle the sharks when they get caught? Because fishermen are fishermen. A lot of the stories are apparently coming from the fishermen, and the actual stories of deliberately drowning the sharks and dragging them back out, a 100 metres back out ... (UP3)

Where is the truth? We'd love to know how it all works, and in each area, do they do it properly? Do they do it the same way, or is it these cowboys that come in and do it? (UP1)

I think the issue we have there is that they are contracting fishermen. (UP3)

Related to this, participants said they distrusted the figures released about the program catch.

But the bycatch is just horrific, the numbers, and the truth of what is actually getting caught by the ten drumlines, we will never know. We will never know what got caught. What I'm told that got caught and what I've read, because I've actively looked it up on the website, the results of what got caught and what I've been told by multiple sources don't stack up by a long shot, by a long shot. And um, yeah, it's a waste of money. (UP5)

The most salient attitudes of the group to SMART drumlines were negative. They said they felt they were unnecessary and a waste of public funds. It was rumoured that the caught sharks were subjected to prolonged suffering, and their conspicuous visibility was raising awareness of sharks and causing unnecessary fear.

5.6.6 Mitigation preferences

This section reports on the attitudes and thinking to mitigation preferences for Narrawallee to Ulladulla. Most of the discussion focused on patrolled and popular areas, with the group indicating that using unpatrolled beaches should be done at 'your own risk'.

There was strong support for drones. They were seen as highly useful and potentially the future of shark mitigation. This was because of the local aspect to them and their ability to coordinate with surf lifesaving (also for identifying non-shark hazards).

The drones, I think are the future. (UP5)

... drones, they are so cheap. (UP3)

... with the drones, it's your local area that you're doing, as opposed to the flight once or twice over the whole day. I would probably still have the same attitude towards SMART drumlines and nets because it's a false sense of security. Once again, that money should be better spent in conjunction with services like surf lifesaving. (UP7)

There was strong opposition to nets for bycatch and apps for creating panic and impacting the economy. This aligned with the attitude that humans should have oversight, as local beach authorities have more experience with dealing with sharks than the general public.

I think that what we do, patrolling and watching and reacting according to what is happening is all that is needed as opposed to prevention. (UP4)

If it was a perceived threat, it would have been different. I would have been straight on the radio. If it was, and that's my judgement, my experience. No, just leave it. It's just like a dog wandering up the street having a sniff around. But if it was big and agitated, that would have been, you know, we've got a marine creature, let's empty the water, and we would have had alarms. (UP5)

The group also expressed support for better education to encourage and enable people to take responsibility for their own safety.

Which is where the education I really believe comes in. I mean, it's just that hypocritical attitude of some people that they believe that they should be able to surf in those areas and be protected from sharks. (UP7)

The Narrawallee - Ulladulla group expressed a range of strong opinions that indicate the importance of close assessment of local preferences and needs to effectively communicate and justify shark management strategies.

5.7 Discussion of findings across the trials

Note: Participants drew clear distinctions between community expectations of shark risk mitigation at patrolled and unpatrolled beaches. Most of the discussions summarised below focused on patrolled rather than unpatrolled areas of the coast.

5.7.1 What are attitudes to and awareness of SMART drumlines?

Low awareness as mitigation

Participants generally had a low awareness of SMART drumlines as a mitigation strategy. Ballina was the exception, where tagging and relocation was perceived to disrupt sharks so much that they stay away from where they were hooked. SMART drumlines were supported in Ballina enthusiastically as part of a 'toolbox' of mitigation strategies.

Awareness and support for SMART drumlines was highest in Ballina and lowest in Ulladulla. Ulladulla participants perceived little risk from sharks in their waters and wondered why their area had been chosen for the trial.

Valued for tagging and research

SMART drumlines are widely valued for their role in tagging sharks and contributing to our understanding of sharks. Understanding movements and behaviours was valued for the potential benefits to both humans and sharks (if we know shark movements and seasons, humans can learn to avoid interactions).

More information wanted – do they attract sharks, how much do sharks suffer?

There were many calls for more information and evidence about SMART drumlines, how they work and what sharks experience after they are hooked.

Some believe that SMART drumlines attract sharks, so they avoid swimming or surfing near SMART drumlines. Some say SMART drumlines should be situated further away from where people use the water in large numbers.

Better than nets – but make contractors accountable

SMART drumlines were generally preferred to nets because SMART drumlines are not usually associated with bycatch or harm to other species. Some are concerned about cruel

treatment of sharks in the catching and tagging processes, and questioned the accountability and behaviours of handlers. There were calls for greater transparency in the processes.

Apart from Ballina, some participants suggested the trials needed to be better justified and communicated to all local stakeholders, especially those with a duty-of-care to beachgoers.

Mostly consistent with previous data

These focus group findings – limited impact on marine life, appreciation for research, low awareness of role in mitigation, and concerns about attracting sharks to bait and suffering of caught sharks - are consistent overall with data DPI had previously collected through surveys and drop-in stands at the trial sites. An important difference here is that focus group participants were concerned for the suffering of caught sharks, not just because of the time it takes for contractors to arrive at the scene but, because of a lack of trust in, and accountability of, private contractors to treat the caught sharks respectfully.

5.7.1 What are the attitudes to and awareness of the SharkSmart App and the VR4G listening stations?

High awareness of SharkSmart App

Group discussions indicated that the SharkSmart App has high levels of awareness in target ocean-user communities. Very few, if any, participants were not previously aware of the SharkSmart App.

Important aid for beach safety authorities – no use to surfers

Ocean users and beach authorities consistently saw value in the app alerts for helping with beach management. There were frequent suggestions to improve the integration of the alert information with lifeguard and lifesaver communication systems. There was very little support for the SharkSmart App from surfers.

Constant app pinging feeds fear – better if information local and specific

Many ocean users reported having downloaded the SharkSmart App and then later abandoned the app because it created fear or anxiety, or was perceived to give mostly

irrelevant information about the whole NSW coast. Further, the frequent alert pings on devices were an irritant to many app users and those close to them (eg partners). Many said they would prefer the SharkSmart App if it was more specific about the number of sharks, size, and direction of movement near ocean users.

Aids beach management, but only protects against the few tagged sharks

The highly visible nature of the VR4G and its placement close to shore has contributed to moderate to high awareness of the VR4G and its purpose. The prevailing attitude across the trial sites was that the VR4G is a very useful tool for beach management. They were seen to be useful for research [although research is not their intended purpose]. However, many perceive that only a low proportion of all sharks have been tagged, making them sceptical about VR4G effectiveness as a risk mitigation tool.

5.7.2 What are the attitudes to and awareness of shark mitigation strategies generally?

Fear of sharks is widely believed to be disproportionate to real risk of harm from sharks. Aside from Ballina, the groups perceived their local risk from sharks to be low.

Real risk is low, but reassurance is important

Some believe that harm mitigation strategies are excessive, considering the low probability from physical harm. However, others feel that mitigation strategies are justified even if all they really accomplish is giving cautious water users reassurance and confidence to enter the water.

In Ballina, which has in recent years experienced heightened shark harm incidents, participants strongly supported the range of strategies currently in place to reduce the risk of harm.

Little is known about sharks - research is encouraged

At each of the sites, there was support for research that improves understanding of shark movements and behaviours. Some emphasised the value to humans, some to the sharks, and some emphasised preparation for future management in the event of harmful incidents.

Avoid harming sharks and other marine life – technology will help

All of the groups expressed concern about harm to sharks and other marine life. There was a strong preference for strategies that avoid such harm. The preference for non-invasive mitigation methods was best exemplified by frequent, unprompted expressions of support for drones. There is widespread belief that drones are ready to dominate mitigation programs, and that improvements to technology will only make them more effective and efficient in a range of conditions and environments. There were several calls for drones to be fitted with sirens to immediately alert beachgoers in danger.

Drones are best – cost efficient, local, non-invasive

Drones were favoured for several reasons. Aerial surveillance tends to be considered more likely to be effective in detecting sharks. However, many participants considered planes and helicopters too expensive and infrequent. On the other hand, they valued drones because they are locally operated, can be directly integrated into local beach management operations and respond rapidly to local need. They also were perceived to be considerably less expensive than aerial alternatives.

Advance local, integrated solutions with humans in charge

All along the coast, people emphasised the need for localised information and management. Further, they expect alerts and other information and communication to be seamlessly integrated with local management and patrol.

Many people expressed a preference for humans experienced in local beach safety to make decisions about shark management.

Overall support for SMS approach

The findings of this study generally support:

- SMS preferences for mitigation strategies that avoid harming sharks and other marine life
- Emphasis on developing technologies and testing emerging approaches, and

Commitment to improving understanding through research.

6 CONCLUSIONS AND RECOMMENDATIONS

The study at the five trial sites identified common and salient attitudes that should be considered when planning and communicating shark management policy.

6.1 SMART drumlines

This study found that some important dimensions of belief drove beach and ocean-user acceptance of SMART drumlines namely:

- The shark's experience of the process of catch, tag and release (most people don't want sharks to suffer);
- The perceived scale of risk of harm from sharks in the locale (Is there a need for mitigation? If not, mitigation may be considered wasteful or mitigation could create fear of sharks where previously no problem was perceived);
- Whether removing sharks taken on baited hooks is valuable risk mitigation, when many more sharks remain in the sea;
- The value of tagging sharks and improved understanding of movements of sharks and seasonality in shark behaviour;
- Whether or not SMART drumlines attract sharks to beaches used for swimming and surfing; and
- The lack of evidence, knowledge, transparency about how SMART drumlines work, shark experiences in tagging and what happens to sharks after release.

Few people in the focus groups said they believed that sharks often suffer greatly during the catch, tag and release process. Some referred to media coverage they had seen. If messages/images of cruelty and suffering are distributed widely to the public in the future, SMART drumlines could become the focus of emotional public debate in the manner of mesh nets. Should this occur, then support for SMART drumlines could quickly evaporate.

6.2 VR4G listening stations and the SharkSmart App

The study found several dimensions of belief influenced beach and ocean users' perception of the value in VR4G listening stations and the SharkSmart App namely:

- The ability of the SharkSmart App to help beach management and those who hold a duty of care to the local community;
- The technologies do not adequately help people at risk in the water;
- Information made publicly available would be most useful if it is timely, accurate, geo-targeted at the locale, and gives specific information about shark numbers (five sharks or one shark detected five times?), the direction sharks are heading, and the size of sharks detected;
- The SharkSmart App reassures tourists or people cautious about ocean use;
- The alerts and listening station belong as part of a complete toolbox for shark mitigation; and
- Alerts and the visibility of the VR4G listening stations raise consciousness of sharks in ways that irrationally increase community fear of sharks.

Many participants said that they saw little effective advantage to making shark movement data available to the general public, and that the data was unnecessarily feeding community fear. However, several participants commented that now that the public have had access to this information, it would be difficult for authorities to ever remove access.

6.3 Mitigation principles

The study suggested several shark harm mitigation principles or lessons:

- People prefer mitigation approaches that do not harm sharks or other marine life;

- Mitigation strategies should be proportional to, and targeted at, local needs;
- People generally prefer a local approach to shark management;
- Detection and alerts are important aids to beach management, but without contextual information, a shark ping alert can cause panic, fear and beach evacuations unnecessarily;
- There is a clear distinction between expectations of mitigation efforts on patrolled and unpatrolled beaches;
- Perceived local need is important for community support for and acceptance of policy;
- Perceived local need is influenced both by objectively defined events (eg shark related harm) and also 'discourse' (what local people are told and are telling each other);
- The prevailing attitude in the groups was that information about shark presence and movements is most effectively used by people with local knowledge and plenty of experience of shark management;
- Integration of services, personnel and communication are important and should be systematised and standardised to improve understanding of expectations of all involved; and
- Some think that 'making tourists feel safer to keep visiting' is sufficient justification for mitigation.

Some participants said they were very grateful for any risk mitigation support. Others said they felt that shark harm mitigation strategies were not justified by the tiny statistical risk of harm from sharks along the long NSW coast. There was a feeling among some that the high visibility of many strategies (drones, SMART drumlines, choppers, planes, VR4G, etc.) creates an unwarranted consciousness, an unjustified fear, and problem of our own making.

6.4 Recommendations

6.4.1 Focus on understanding locale, localising strategy with beach managers, provision of locally useful shark information and alerts, and justifying strategies locally.

6.4.2 Contribute to a process for improving the integration, cooperation and communication between detectors and all with local responsibility for beach safety, eg Draft a governance document with local authorities to guide the development of management strategies.

6.4.3 Communicate well and often with the public – perceptions are important for policy success, in the absence of information, people will speculate and find their own information sources and stories. Explain, justify and promote success stories using a range of media.

6.4.4 Address the perception that SMART drumlines attract sharks, or people may reject locating SMART drumlines anywhere near people.

6.4.5 Address the dominant perception that SMART drumlines are just for research.

6.5.6 Build community confidence in contractors handling sharks (consider a role for scientists and/or the DPI).

6.5.7 Be transparent and provide evidence of efficacy of interventions (eg shark outcomes after SMART Drumline release).

6.5.8 Address uncertainty about outcomes for sharks caught by SMART drumlines; rebut or justify claims of suffering before, during and after tagging.

6.5.9 Clarify the purpose of VR4G listening stations and their role in the strategy;

6.5.10 Conduct research into understanding the features of mitigation strategies that drive reassurance and fear;

6.5.11 There is optimism about technology playing an ever increasing role in beach safety (eg drones with sirens). Continue investing in R&D for technologies that mitigate risk to humans, sharks and other marine life.

6.5.12 Support effective resourcing and communication for dedicated popular and patrolled areas of coast.

6.5 Recommendations for any future trials

6.5.1 Select locations where interventions are well justified.

6.5.1.1 Scientific justification is important, but social and economic justification also need to be included.

6.5.1.2 Social research should conclude that the locals are sufficiently in favour of/ perceive a need for the trial.

6.5.2 Plan for controlled and uncontrolled communication.

6.5.2.1 Communicate the proposed trial with a feedback loop, so that locals have a voice.

6.5.2.2 Embed the DPI in the community to ensure need is warranted and understood. This should not just include beach authorities and local councils, but concerned business groups, key influencers and the broader community.

6.5.2.3 Develop a plan to manage misinformation and rumour.

6.5.2.4 Be open about potential unintended or undesirable consequences eg increased fear and tourism drop-off.

6.5.3 If a trial proceeds – meet expectations of transparency and local service integration.

6.5.3.1 Select a reputable contractor, and ensure transparency in practice to avoid negative public relations.

6.5.3.2 Ensure it is integrated with local practices, eg beach authorities/aerial patrol.

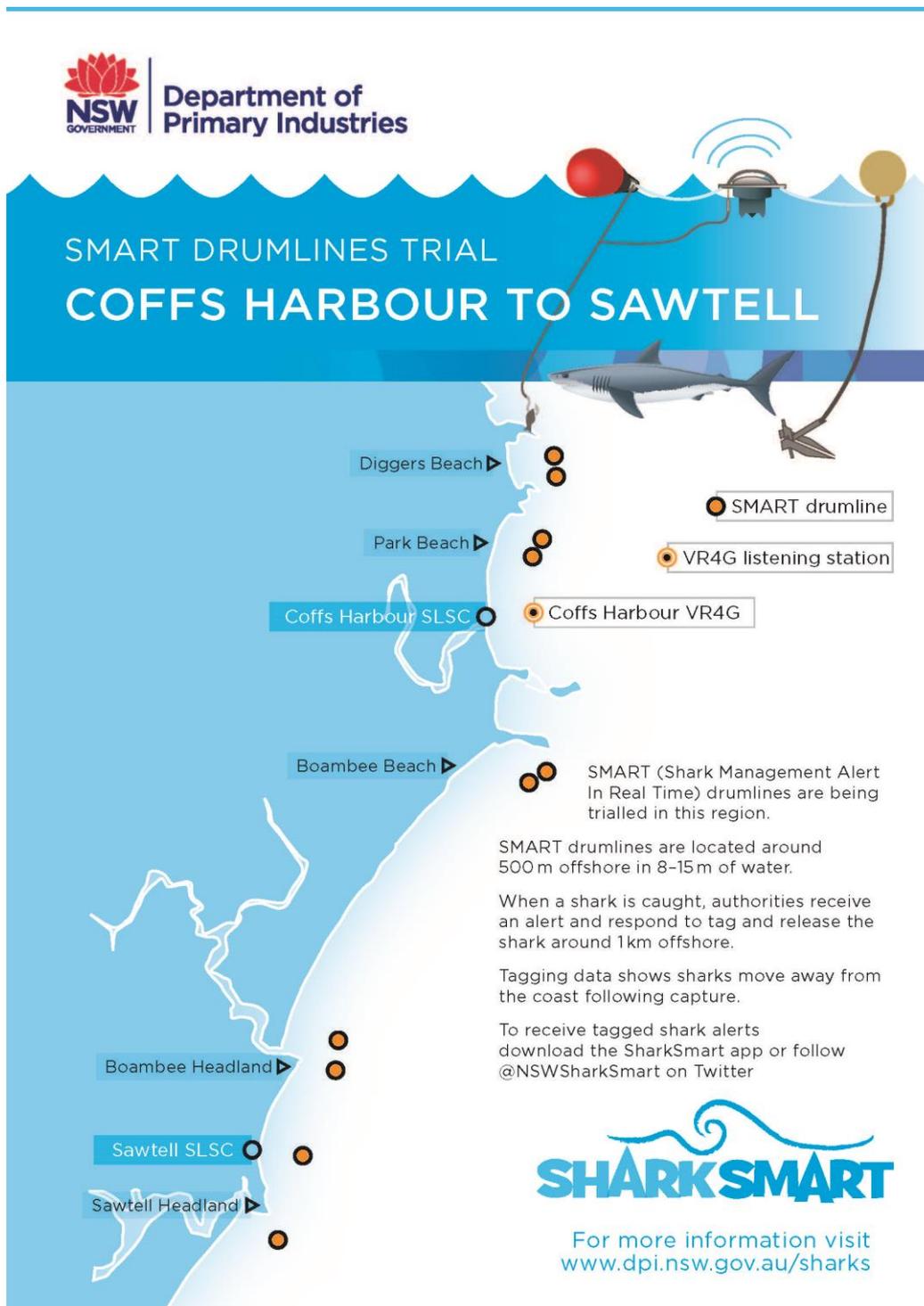
6.5.3.3 Demonstrate transparency of process and action, including catch/release of sharks.

6.5.3.4 Create an online portal to localise information eg website.

6.5.3.5 Follow up at the end of the trial to debrief and get a sense of what the locals think and feel about the mitigation trial.

7 APPENDICES

Appendix 1. Beach sign example.



Appendix 2. Community drop-in stand



Appendix 3. Discussion guide

Assessment of the attitudes of beach and ocean users to shark mitigation since trials of SMART drumlines in NSW.

FG Questions	Prompts
<p>Before the start – everyone completes a participant profile sheet. RECORDING</p>	
<p>Moderator Opening – min 0</p> <p>Welcome and thank you for giving your time for this study.</p> <p>My name is Peter Simmons and this is Michael Mehmet. We work with ILWS research centre at CSU. [We are running this study with Dr Belinda Curley, a marine scientist from the NSW Department of Primary Industries.]</p>	
<p>Introduction – min 1</p> <p>Take a minute to introduce the session - then start talking</p> <p>Today, we will be talking about some approaches to managing sharks, including SMART drumlines, listening stations and apps</p> <p>The results will be used in a report and papers we will give to the Department of Primary Industries to help inform their policy and communication around sharks and shark management.</p> <p>You were chosen because you have an interest in or experience of the NSW coast.</p> <p>A few principles to guide our discussion</p> <p>This is a round table where all views are important and it's important to hear from everyone.</p> <p>There are no right or wrong answers, just differing points of view.</p> <p>We're taping the session, so we need one person speaking at a time.</p> <p>You don't need to agree with others, but you need to listen respectfully as others share their views.</p> <p>People have agreed to come here today on understanding of confidentiality, so I urge you not to repeat what is said.</p> <p>Mobile phones off please.</p> <p>My role as moderator will be to guide the discussion.</p>	
<p>Ice breaking – introductions – min 3</p> <p>Start with introductions – I'll go around the room ... [in less than a minute] can you introduce yourself (by name for our transcriber, Glenda) and tell us about the ways that you use the beach or ocean?</p>	
<p>Exploring – general attitudes to shark mitigation - open ended questions about going in water – min 13</p>	

<p>I can hear that many of you go in the water. What are your thoughts about going in the ocean?</p> <p>What do you like and not like about going in the ocean?</p>	<p>How far? Time of day? Conditions? Risk?</p>
<p>I'll go around the room: In your scheme of things, are sharks a problem?</p>	<p>Scale and nature; risk dimensions</p>
<p>Focus question – Detection and alerts – min 23</p>	
<p>In recent years, the NSW Government has introduced a 'Shark Management Strategy'. It has three main approaches to preventing harm:</p> <p>First, methods to detect sharks and alert people about sharks (aerial - helicopters and drones, and in water – VR4G and Clever Buoys);</p> <p>Second, catching methods such as SMART drumlines and Mesh nets;</p> <p>Another type is the exclusion method (barriers) - not talking about that today.</p>	
<p>I will start with some questions about detection and alerts.</p> <p>How and when is it valuable to know where sharks are? Do you want to be informed about sharks near your beach? And should authorities to make the information available to the community?</p> <p>Start with ...</p>	<p>Awareness?</p> <p>Is it important?</p> <p>In real time?</p> <p>For you? For others?</p>
<p>What are the benefits and limitations of the different approaches [aerial / marine] to monitoring and surveillance?</p>	<p>Reassurance /Effectiveness</p> <p>Costs</p> <p>Aerial – drones/helicopters</p> <p>Marine</p>
<p>What are different ways people can be alerted about sharks?</p>	<p>What are channels?</p>
<p>Moderator explains. VR4G and SharkSmart - (Michael hands out VR4G diagram – Yellow buoy)</p> <p>Here in [insert location] you have had what is called a VR4G listening station. The (VR4G) listening station detects tagged sharks and other marine animals within 500m. Captured information goes immediately to a satellite and is then sent to the public and beach authorities via Twitter @NSWSharkSmart and the SharkSmart App. 20 listening stations along the coast.</p> <p>SharkSmart App. The SharkSmart App is owned by NSW DPI. It receives information about shark movements from all the network of listening stations, as well as detections from drones, helicopters and sharks caught on SMART drumlines.</p> <p>It makes the information freely available to the general public. People with the app on their devices, especially phones, can receive instant alerts about sharks ... this way the public can monitor shark activity.</p> <p>So the VR4G detects tagged sharks within 500 metres ... communicates that</p>	<p>Separate V4RG and SharkSmart?</p>

to the SharkSmart App and Twitter to followers	
Do you see a role for the VR4G?	Do you see value for detecting and alerting, or for monitoring and research? Reassurance Effectiveness Costs Research? Harm reduction?
Does this approach change the way you or the community use the beach or ocean?	
For those who said that [insert tech] did not suit, what alternatives, do you prefer that would achieve the same outcome?	
Let's now talk about alerts ... do you see a role for the SharkSmart App?	Do you see value for detecting and alerting, or for monitoring and research? Reassurance Effectiveness Costs Research? Harm reduction?
Does this approach change the way you or the community use the beach or ocean?	
For those who said that [insert tech] did not suit, what alternatives do you prefer that would achieve the same outcome?	
Focus question - Catching sharks - SMART drumlines – min 55 We have talked about surveillance and detecting sharks. I now want to talk about catching sharks.	
I'll open this to the group ... Can you tell me your thoughts about catching sharks? What are the advantages and disadvantages of catching sharks?	Is catching a good thing to do? Where to catch? Lethal – non-lethal Reassurance Effectiveness Costs
SMART drumlines (Shark Management Alert in Real Time) In this area, you have recently had a trial of SMART drumlines and we are	

very interested in your opinions.	
<p>Moderator explains and shows two DPI diagrams – Diagram 1 shows SMART drumlines illustration, Diagram 2 shows local map of locations.</p> <p>SMART drumlines capture sharks with a baited hook and alert a response team. The team respond immediately to tag and relocate the shark alive one km out to sea. Because they have bait, they need to be brought in each day.</p> <p>Only used when a team is on hand to respond.</p> <p>We talked about alerts from tagged sharks, SMART drumlines is the way most are tagged.</p>	
Let's go around the room. What do you like and not like about SMART drumlines?	Difference between SMART and dumb?
How do you feel about entering the water when the SMART drumlines are operating?	
<p>Think back to before the SMART drumlines were introduced. How did you feel about entering the ocean before?</p> <p>Did the SMART drumlines change the way you think about using the ocean? How you use the ocean? Or how often you went into the water?</p>	
If not covered: Do you feel that SMART drumlines are appropriate for this area?	
Wrap up – min 75	
How would you describe the shark management needs of this region?	This location – what's special?
All things considered - Are we managing our beaches and sharks appropriately?	

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