



## DISCUSSION PAPER

### **Shark bite mitigation strategies in the ocean off Esperance**

*The Gary Johnson Foundation and the Local Environmental Action Forum (LEAF) collaboratively developed this paper in response to the community's reaction to 3 recent and fatal shark bite incidents in Esperance. Laetitia Brouwer died from a shark bite in April 2017, Gary Johnson in early January 2020 and surfer Andrew Sharpe died in October 2020. Demands for political action have resulted in emotional and polarised views in the Esperance community. The ambition of this paper is to encourage informed and collaborative discussion and action.*

### **Abstract**

Shark bites have become increasingly frequent globally. While the risk of shark encounters remains low compared to other threats (e.g. drowning and rock fishing), the low probability-high consequence of shark bite incidents skews risk perception and drives emotional responses to the problem. The distinct trade-off between the protection of ecologically significant White Sharks and the safety of beachgoers, and conflicting values of stakeholders, has divided the Esperance community over potential solutions to the problem. There are many existing and emerging shark bite mitigation technologies that are non-lethal and proving effective. Lethal measures have demonstrated low levels of efficacy across Australia. Community and government collaboration and further research is required to establish the status of White Sharks, potential causes of shark encounters in the Esperance region and effective mitigation strategies that will provide short and long-term solutions to the problem.

## **Shark bite mitigation strategies in the ocean off Esperance**

### **Introduction**

White Sharks (*Carcharodon carcharias*) are large, top-order marine hunters responsible for most lethal and non-lethal shark bites in the Esperance region<sup>1,2,3</sup>. As apex predators, they are ecologically significant in maintaining ecosystem structure and function and preventing the collapse of food chains (via trophic cascades)<sup>4</sup>.

The depleted population sizes and life history characteristics of sharks make them vulnerable to unprecedented human (anthropogenic) pressures and overexploitation, which have caused the long-term decline of many species' populations<sup>5,6,7</sup>. The white shark is endangered and since species protection in 1997, there is some indication there has been a small increase in the size and number of the population in Western Australia<sup>1,8</sup>. Conflicting evidence over the population growth or decline of white sharks, and the lack of robust abundance indicators, means that a thorough status assessment of White Sharks is required<sup>4</sup>.

There are a range of biological, environmental, and human factors that potentially influence shark behaviours<sup>10,11</sup>. Examples include direct fishing pressures, water temperature, reduced prey species, climate change, pollution, distance from shore, the use of burley, water runoff, and human interactions with the ocean and sharks. Different locations exhibit unique contributory factors and identification of local factors is crucial for effective evidence-based mitigation strategies<sup>1,9,10</sup>.

### **What research indicates**

Shark encounters have increased globally since the 1990's<sup>9,12</sup>, even so the risk of unprovoked white shark bites remains low comparative to other threats<sup>1,2,3</sup>. Rock fishing and drowning have significantly higher mortality rates in Esperance<sup>13,14</sup>. However, the low probability–high consequence of shark bite incidents can skew risk perception and engender fear in the community<sup>1,15</sup>. This is intensified by a disproportionately high levels of media exposure<sup>15,16,17</sup>. This fear can drive calls for immediate and emotional demands for political action directly following an incident<sup>13,15</sup>. Communities become divided over potential responses, particularly when there are calls for lethal solutions<sup>1,18,19</sup>. Short-term and immediate measures are important to relieve public

anxiety<sup>1</sup>. However, responses that reinforce public perceptions of high shark bite risk and are based on emotional suggestions of severe and on-going threats of shark attacks provide an opening for the introduction of low efficacy strategies<sup>1,18</sup>. Strategies called for are often lethal, inhumane, harmful to other marine organisms and provide the community with a false sense of safety<sup>1,15,19</sup>. Shark bite mitigation strategies will be most effective if developed in collaboration with governments and all voices in the community are heard<sup>20</sup>.

### **Mitigation Strategies**

There are a range of shark bite mitigation strategies in effect in Australia, some lethal, some less humane, and with various degrees of efficacy. Beach meshing, lethal drumlines and targeted shark culls represent lethal responses. These measures can have high levels of bycatch and have proven ineffective in preventing shark bites<sup>1,21,22</sup>. In 2014, drumlines deployed in Perth and south-west WA beaches predominantly caught tiger sharks (91% of catches), which are generally not responsible for fatalities<sup>22</sup>. SMART drumlines deployed in the same region, between 21 February 2019 and 20 February 2020, also failed to catch the target species, with only two out of 182 captured sharks being white sharks<sup>23</sup>.

There are a growing number of strategies that do not use lethal and inhumane methods, appear to be more effective and do not result in a high by-catch of threatened species including marine mammals. Examples include surveillance drones and helicopters, educational signs and community education, humane shark spotters, shark safety apps, and global, eco and electromagnetic shark barriers<sup>23,24,25</sup>. There has been varied results on the effectiveness of personal deterrents devices and much ongoing research and innovation to develop more effective devices<sup>25</sup>.

### **Future Directions for Esperance**

- Public policies and mitigation strategies will require to contend with the need for public safety as well as the responsibility to protect endangered shark and other marine species.
- Better information is required on the status (numbers and size) of White Sharks and potential causes of increased shark encounters in Esperance.
- Proactive and effective short and long-term shark bite mitigation strategies are best developed collaboratively listening to all voices in the community and involving the three spheres of Government.
- The introduction of timely and effective short-term measures to address public anxiety is important. There is the opportunity to adopt measures that are based on solid and emerging technologies that are humane and effective.

- Lethal responses have failed to provide indications of efficacy and are not widely supported. Further, the efficacy of SMART drum lines needs to be considered in the light that there are and more modern, humane and effective strategies available.
- Ongoing tagging of White sharks in the Esperance region provides valuable research information.
- Evidence, information and community consultation and education will reinforce the success of any future shark bite mitigation strategies. All voices in the community need to be heard and the adoption of a collaboratively approach to the development of effective short and long-term shark bite mitigation strategies is required.

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