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Transforming shark hazard policy: Learning from ocean-users and shark encounter in Western Australia

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ABSTRACT

Killing sharks is a popular strategy for reducing risk for beach-goers and ocean-users. But the effectiveness of kill-based strategies is debated and the ecological and economic costs are high. In Western Australia the state government introduced new policy in 2012 in response to shark-related fatalities, to track, catch and destroy sharks deemed to pose an 'imminent threat' to beach-goers. This paper reports on a survey of Western Australia-based ocean-users, and pursues two aims: to develop an understanding of the experiences of ocean-users in encountering sharks; and to learn about the attitudes of ocean-users towards shark hazard management. The research finds that people encounter sharks often, without harm, and that most ocean-users adapt their practices in order to reduce personal risk. The majority of ocean-users oppose the kill-based elements of the new policy, and kill-based shark hazard management strategies more broadly. Rather, ocean-users strongly support further research and education focusing on shark behaviour and shark deterrents, and approaches that enable people to understand and accept risks associated with ocean use. These findings present opportunity to refocus debates about shark hazard management on non-lethal strategies in concert with better educating publics so they can make informed decisions about their ocean-based activities.

1. Introduction

Over a ten-month period during 2011 and 2012, five human fatalities tragically occurred in Western Australia (WA) as a result of shark bite. In reporting the incidents print and television media labelled WA 'Shark attack capital of the world' [1]. Following the fifth fatality in July 2012, the WA government made substantial change to the state's environment and fisheries policy, allowing proactive killing of sharks sighted 'in close proximity to beach-goers' [2]. After a sixth fatality in November 2013 the policy was broadened further. To supplement the proactive kill strategy two 'Marine Monitored Areas' (MMAs) were established; one off Perth's metropolitan beaches and the other in the state's south-west, a region popular with surfers and tourists. Each MMA stretches from the shoreline 1 km into the Indian Ocean. A series of large baited hooks – known as drumlines – was deployed at the boundary of each MMA to catch sharks. Private fishing companies initially contracted to patrol each zone were tasked with killing sharks over 3 m in length caught on the drumlines or spotted inside the MMAs. Each area thus represented what the media described as a 'kill zone' within which professional fishers were paid to patrol, destroy and dispose of sharks [3].

The program targeted tiger sharks (*Galeocerdo cuvier*), bull sharks (*Carcharhinus leucas*) and great white sharks (*Carcharadon carcharius*), three species identified in Australia as potentially 'dangerous to humans' [4,5]. The drumlines were set and maintained between 25 January and 30 April 2014. Two million dollars was allocated to this strategy, as part of a AUD $6.85 million shark mitigation package, and in addition to a $13.65 million package announced in the previous year. In order to undertake the fatal elements of the strategy the WA government sought and received exemptions from its responsibilities under the *Environment Protection and Biodiversity Conservation Act 1999*, *Fish Resources Management Act 1994* (WA) and the *Wildlife Conservation Act 1950* (WA). In June 2014 the WA government proposed to continue the lethal approach to sharks for a further three years. Drumlines were to be set annually between 15 November and 30 April (peak beach-use season). But in September the state's Environmental Protection Authority recommended against the proposal, citing the 'high degree of scientific uncertainty about impacts on the viability of the south-western white shark population' [6].

This paper responds to recent human–shark encounters, policy change, and associated public debate about use and management of marine environments. In particular, it investigates the experiences and attitudes of ocean-users. The paper pursues two aims:

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to develop an understanding of the experiences of ocean-users in encountering sharks; and to learn about the attitudes of ocean-users towards shark management. Despite the high public profile of shark bite events and recent policy change in WA, research has not yet focused on the people who use the ocean on a regular basis, and who are therefore most likely to come into contact with sharks; a group described here as 'ocean-users'. This group comprises swimmers, board riders, divers, fishers, Surf Life Savers, and people who undertake other recreational, volunteer, and professional activities on or in the ocean as part of everyday life.

2. Killing sharks as hazard mitigation policy

The WA government's Shark Hazard Mitigation Strategy is not isolated in its lethal approach towards managing human–shark encounters. On Australia's east coast, New South Wales (NSW) has operated a shark meshing program since 1937 [7]. There, specialised nets are placed along 51 of the state's popular beaches between September and April each year. The nets are designed to entangle and trap sharks. In 2011–12 contractors caught 158 sharks; 102 were killed (a mortality rate of 65%), and only 15 were species identified as dangerous to humans [7]. Following two fatalities in 1961 the state of Queensland (QLD) implemented a stringent policy approach to sharks, including widespread use of baited drumlines in addition to shark nets [8]. In 2012, 753 sharks were caught by private fishing contractors off the QLD coast, a catch increase of 25% over the previous five years [9]. The QLD shark control program is particularly lethal. The average annual mortality rate is 94%, with three-quarters of all sharks dying while ensnared on baited hooks (per. comm. QLD Shark Control Program manager, Feb 2014).

Outside Australia a shark control program employed in South Africa's KwaZulu-Natal Province also uses shark nets and baited drumlines [10,11]. According to the program's board the nets (totalling 23.4 km) and drumlines 'function by reducing shark numbers in the vicinity of protected beaches, thereby lowering the probability of encounters between sharks and people at those beaches' ([11]; see also [12]). In other words, human risk is reduced by killing large numbers of sharks, most of which pose no threat to human life. In July 2013 the French territory of Reunion Island introduced measures in response to a number of incidents, including three shark-related fatalities, in the preceding two years. Actions included prohibition of swimming, surfing and body boarding in particular areas, and culling of 90 sharks (45 bull and 45 tiger sharks), the latter promoted as part of an existing study into food safety and shark risk management. By categorising these killings as part of a scientific study, authorities have been exempt from their legal responsibility to protect species, including bull sharks [13,14]. As in WA, action to kill sharks is not legislated, but enabled through exemption from existing legislation.

While shark nets have been used in KwaZulu-Natal since 1952, deployment of baited drumlines is a more recent development. According to Cliff and Dudley [12, p. 706] the decision to use drumlines in KwaZulu-Natal was 'a direct result of a detailed comparison with the shark-control programs in Queensland and New South Wales' (see also [11]). A 2009 report described the NSW Shark Meshing Program as 'effective in reducing the incidences of fatal shark attack at major metropolitan beaches, with only one fatal shark attack on a netted beach since the SMP began' [15, p.1]. But the effectiveness of kill-based approaches is questionable and geographically variable [16]. Between 1959 and 1976 shark culling carried out across the Hawaiian Islands killed 4668 sharks. Yet there was no measurable reduction in the rate of shark bite over the 17-year period, or in the years since the culling ceased [17,18].

The impacts of kill-based control programs on shark populations and marine ecology are substantial, including negative implications for populations of threatened shark species, potential effects of removal of large predators from near-shore areas, and mortality of diverse by-catch of non-target shark species, rays, turtles and cetaceans [12,16]. O'Connell et al. [19, p. 38] have noted that 'anthropogenic sources of shark mortality have had a major negative influence on local and migratory shark populations'. The NSW Shark Meshing Program is listed as a Key Threatening Process under both the *Fisheries Management Act 1994* (NSW) and *Threatened Species Conservation Act 1995* (NSW). The Office of Environment and Heritage defines a Key Threatening Process as something that threatens or potentially threatens the survival or evolutionary development of a species, population or ecological community. Further, numerous unknowns complicate interpretation of catch data from shark control programs, including increases in beach use by people, fishing pressure outside shark program areas, and scientific understanding of shark behaviour and geographic movement [15,20].

Over the last decade lethal approaches to reducing risk of shark bite have also been adopted in New Zealand, Egypt, Russia, the Seychelles and Mexico [21]. In popular coastal regions where tourism and ocean use represent important sources of leisure and revenue, killing and culling policies for managing human–shark encounters are increasingly prevalent. An increase in lethal approaches towards managing sharks comes despite questionable effectiveness in reducing risk to human safety, and considerable environmental and economic cost [12,15,16,18,19,22].

3. Surveying attitudes to sharks and shark hazard policy

Effective shark hazard mitigation policy is dependent on better understanding of shark behaviour and ecology, efficacy of mitigation technologies and techniques, and cultural attitudes and practices. As such, policy should be informed by both the physical and social sciences. A number of surveys have been undertaken in recent years investigating attitudes to sharks and shark hazard management. Two studies of public perception have identified positive attitudes or values associated with sharks. Friedrich et al. [23] investigated public perceptions of sharks and shark conservation in the UK, focusing on people who have a demonstrated interest in marine environments. Their survey of 135 respondents in June–July 2011 found that regular aquarium visitors, frequent coast visitors, and people with experience of sharks in the wild tended to have more positive and stronger pro-conservation attitudes towards sharks than others. In a pilot study of public attitudes to sharks before and after a shark bite incident in Cape Town, South Africa, Neff and Yang [21] surveyed 100 respondents across two beach locations in June and October 2011. They found that value attributed to endemic shark populations, and confidence in beach safety organisations, remained unchanged following a shark bite incident.

Two recent studies conducted by private research firms in response to events in WA have found a high degree of opposition to culling or killing sharks as a hazard mitigation strategy. A randomised survey of 500 people conducted by UMR Research found that 83% of Australians have not changed how they use the ocean as a result of the risk of shark attack. Further, 82% did not think sharks should be killed, and believed that people enter the water at their own risk [24]. A WA government-commissioned survey aimed to understand views of personal accountability towards mitigation of shark risk, and how fear of sharks has altered community behaviour [25,26]. The study surveyed 768 WA residents in April 2013. It found that the majority of respondents (46% measured on a five-point Likert scale) had not changed their