SYDNEY COASTAL COUNCILS GROUP INC.

councils **caring for the coastal environment**

SUBMISSION

Five year review of the 2009 Joint Management Agreements for the NSW Shark Meshing (Bather Protection) Program

March 2016

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Date: 31 March 2016

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Introduction

Established in 1989, the Sydney Coastal Councils Group (SCCG) is a co-operative organisation with twenty-five years' experience in leading sustainable coastal management. The SCCG currently comprises fourteen Member Councils who represent over 1.4 million Sydneysiders, and is the peak NSW ROC representing coastal councils and the third largest based upon population (Gooding, 2012).

SCCG Member Councils share a strong interest in mitigating shark encounters whilst minimising harm to marine animals and the marine environment. The management of sharks requires a delicate balance between maintaining public safety and providing for the conservation of threatened, protected and non-target species. As such, the issue must be considered in the broader context of sustainable marine management. The SCCG has a long and involved history in this area, being strong advocates for the establishment of Intertidal Protected Areas and forming part of the expert panel assessing and declaring Sydney's aquatic reserves.

The SCCG prepared a submission to the October 2015 Inquiry into the Management of Sharks in New South Wales Waters and we refer you to comments made in that submission (Appendix 1).

The SCCG welcomes the opportunity to contribute to the five year review of the Joint Management Agreements for the NSW Shark Meshing (Bather Protection) Program.

This submission includes:

Section 1. General comments

Section 2. Comments relating to the *Five year review of the 2009 Joint Management Agreements for the NSW Shark Meshing (Bather Protection) Program January 2016* public exhibition document

Section 3. Comments relating to the *DRAFT Joint Management Agreement and DRAFT Management Plan for the NSW Shark Meshing (Bather Protection) Program Public Exhibition Document January 2016*

Section 1. General comments

The SCCG acknowledges that the management of sharks is a sensitive and politically charged issue. Many members of the community are aware of the important role of sharks as apex predators in marine environments, and place high value on their continued existence in NSW waters (SEA LIFE Conservation Fund, 2014). However, whilst rare, violent encounters with sharks are extremely traumatic for those affected.

1.1 Investment in non-lethal shark detection and deterrent technologies

The SCCG acknowledges and welcomes the NSW Government's investment in aerial surveillance and trialling new technologies under the new Shark Management Strategy (NSW Department of Primary Industries Fishing and Aquaculture, 2015).

Recommendation 1: The SCCG strongly supports and encourages the use of non-lethal mechanisms for improving bather safety.

1.2 Importance of sharks to the marine ecosystem

According to the International Union for the Conservation of Nature (IUCN), a quarter of the world's sharks and rays are threatened with extinction (International Union for the Conservation of Nature, 2014). Sharks are inherently vulnerable species due to their relatively long life expectancies, the time taken to reach sexual maturity and their low fertility rates (Australian Government Department of the Environment, n.d.). These figures are all the more concerning since sharks play a critically important role in the marine ecosystem as 'apex predators'. Changes in their population and distribution have corollary impacts on other marine species and may disrupt the marine ecosystem as a whole. It is therefore important that any shark management strategies consider the role of sharks in the ecosystem.

Recommendation 2: Shark management strategies determined must consider the role of sharks in the ecosystem and any adverse impacts that nominated management strategies might have on the ecosystem as a whole.

1.3 Appropriate metrics and language

The *Five year review of the 2009 Joint Management Agreements for the NSW Shark Meshing (Bather Protection) Program January 2016* (henceforth referred to as 'the Review') and other communication materials from the Department of Primary Industries (DPI) make comparison between the numbers of fatalities due to shark bites before and after the beginning of the Shark Meshing Program (SMP) in 1937. This is inappropriate and misleading as the number of fatalities is influenced by multiple variables including (but not limited to) improvements in medical science in the intervening eight decades and the time from incident to receiving medical care.

The Review presents the information that since 1937 there has only been one fatal interaction at a meshed beach, compared to 12 fatalities at unmeshed beaches in NSW, as a direct comparison (NSW Department of Primary Industries, 2016, page 1). This statement is repeated on the DPI Fisheries website (NSW Department of Primary Industries Fishing and Aquaculture, n.d.). This implies a causal link between meshed beaches and the reduction (not elimination) of fatalities at meshed beaches. The comparison however conflates multiple variables – the type of interaction, advances in medical treatment, the time elapsed between the interaction and treatment, variability in the recording of shark interactions prior to the establishment of the Australian Shark Attack File in 1984 (West, 2011), the presence of surf lifesavers and aerial observers spotting sharks and warning bathers, as well as whether beaches are meshed or unmeshed. It also obscures the fact that the length of unmeshed coastline in NSW (around 900km) vastly exceeds the combined length of meshed beaches (the Review, pages 1, 6), meaning that a direct comparison of either fatal interactions or total interactions on meshed vs unmeshed beaches is not a geographically meaningful comparison.

Recommendation 3: The SCCG recommends a more rigorous scientific assessment of the success or otherwise of the SMP in achieving its objective of reducing the incidence of shark attacks on bathers while minimising the impact of the SMP on target and non-target species, and the public release of the results of this assessment.

Recommendation 4: The SCCG recommends greater transparency in all NSW Government communications about the SMP regarding the level of uncertainty when assessing whether the SMP can be credited with reducing the number of shark interactions.

Recommendation 5: The SCCG further recommends that the language used in all NSW Government communications not use fatalities as an indicator of success. The number of fatalities is influenced by multiple variables and this is not a valid metric by which to measure the success or otherwise of the Shark Meshing Program. The number of interactions with sharks is a more appropriate metric than fatalities.

1.4 Impact on non-target vs target species

While the evidence that the SMP is achieving the first part of its stated aim, "to reduce the chances of shark interactions within the area of operation of the program" is questionable, there is substantial evidence that it is not meeting the second part of this aim, "whilst minimising impacts on non-target species" (Draft Management Plan public exhibition document, page 5).

The Review paper records that the ratio of non-target to target species caught in SMP nets over the past 15 years is approximately 2.6:1, and may be as high as to 5:1 (depending on month and year examined).

The NSW Scientific Committee's review of the Shark Meshing (Bather Protection) Program (SMP) 2014-15 Annual Performance Report notes "*that there continues to be more interactions reported with non-target (77%) compared to target (23%) species*

and suggests that the effectiveness of the SMP on target species should be weighed against the evidence of its relatively greater impact on non-target species" (Eldridge, 2015). The SCCG understands that the Scientific Committee regularly raises ongoing concerns about the impacts of the SMP on non-target species as mortalities for protected and threatened species continue to be recorded for every year of the SMP's operation.

The SCCG acknowledges the need to promote public safety at popular beaches, but is deeply concerned about the ongoing negative impact of the Shark Meshing Program on the wide range of non-target species, in particular (but not limited to) threatened and migratory species. As a signatory to the Convention on Biological Diversity, Australia has an international legal and moral responsibility to protect biodiversity in general and threatened species in particular in our waters. To continue to operate a program that culls numerous non-target species, some of which are threatened, for eighty years is not consistent with our international obligations.

Section 2. Comments relating to the Five year review of the 2009 Joint Management Agreements for the NSW Shark Meshing (Bather Protection) Program January 2016 public exhibition document

2.1 Target and non-target species caught on the shoreward side of SMP nets

The Review paper points out that in the KwaZulu-Natal shark meshing program in South Africa, 35% of sharks caught in the nets are caught on the inshore or shoreward side of the nets (Cliff & Dudley, 1992, cited in the 2016 Review, page 5). The review paper goes on to state that "*the barrier effect* (of the nets) *is likely to be negligible*" (page 5). However the review does not provide the same information for the percentage of sharks caught on the shoreward side of NSW SMP nets.

This is an important gap in the current public reporting on the SMP. While it is acknowledged on the Department of Primary Industries website and other DPI communications materials that SMP nets do not act as complete barriers between sharks and bathers, information on the percentage of sharks caught when approaching the net from the shoreward side is an important indicator to bring home to bathers the message that the nets do not prevent sharks from accessing coastal bathing areas.

Recommendation 6: The SCCG recommends that the percentage of target and non-target species caught on the shoreward side of the SMP nets in NSW is also captured and included in the publicly released catch reports.

2.2 Efficacy of shark nets at Redhead Beach

The Review states that the SMP nets at Redhead Beach have only caught two White Sharks since 1999-2000, and recorded three human/shark interactions, despite the "relatively high numbers of White Sharks (that) are known to use the area" (page 6). The term "relatively high numbers" is not defined or substantiated with any data.

Q2.2.1 The SCCG seeks clarification as to what is meant by "relatively high numbers" of White Sharks known to use the area of Redhead Beach and what evidence there is for this statement.

Regardless, the claim that the "data suggests that the SMP has substantially reduced the incidence of shark interactions, by up to 90% in the Hunter and Sydney regions" (page 7) does not appear to be supported by the evidence at Redhead.

2.3 Performance Indicator for Objective 11.1.3: Change in the number of major or minor workplace incidents reported by contractors or observers

The SCCG has no objection to the Review paper's recommended modification to the Trigger point on major and minor Workplace Health and Safety incidents following the incident of a slip and fall of a contractor in 2012 (Review page 8 and Draft JMA page 6).

2.4 Marine mammal entanglements

The entanglement of three Humpback Whales over two successive years and the subsequent drowning of one of those individuals (a calf) is of great concern to the SCCG, our Member Councils and the general public.

The whale migration season lasts from mid-May until the end of November (NSW National Parks and Wildlife Service, n.d.), and there is evidence to suggest that the migration season for Humpback Whales may be extending as their numbers increase (McDonald, 2015). It is very possible that the likelihood of whale entanglements may increase as population numbers recover and migration patterns change.

The Conservation Management Plan for the Southern Right Whale shows a number of emerging calving grounds in Victorian coastal waters in the revised version published in 2012 (Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2012). This may be an indicator that as the species recovers, calving grounds may also be established at more locations including along the coastline of NSW where whales are frequently sighted sheltering inshore with calves. For example, a Southern Right Whale gave birth off the coast of the Sydney Northern Beaches in June 2014 with the pregnant whale sighted the day before inshore at Warriewood Beach in Pittwater (Manly Daily, 2014).

Also of concern is the fact that whales, dolphins, seals and occasionally dugongs continue to be caught in SMP nets despite the setting of the nets at least 6 metres below the surface of the water to reduce the chances of marine mammal entanglements, and the use of cetacean alarms or 'pingers' to deter cetaceans away from nets.

Different species of cetaceans hear and are likely to be sensitive to different frequencies. Baleen whales and some toothed whales are believed to be sensitive to lower frequencies, while smaller dolphins and porpoises have peak sensitivities in the higher frequency range (Australian Government Department of the Environment, Water, Heritage and the Arts, 2008).

These recent entanglements raise important questions on which we request clarification from DPI Fisheries and/or the Office of Environment and Heritage:

Q2.4.1 What evidence is available that cetacean 'pingers' and other alarm systems are efficient at reducing SMP net interactions with cetaceans?

Q2.4.2 Has any research been conducted on any possible negative effects of 'pingers' and other alarms, on marine wildlife?

Q2.4.3 What efforts will be made to increase the numbers of Large Whale Disentanglement Teams along the geographical extent of the Shark Meshing Program beaches?

Q2.4.4 Do Large Whale Disentanglement Teams only respond to entanglements of whales? Who releases smaller wildlife such as dolphins, dugongs, seals and turtles from entanglement in SMP nets?

The Review concluded that the slow response time from NPWS Large Whale Disentanglement Team (LWDT) to the Humpback calf drowning incident was due to insufficient, widely spread team members. This is both a specific problem of the Shark Meshing Program that must be addressed, and a symptom of the broader problem of insufficient staffing levels and resourcing of NPWS. It should also be acknowledged by DPI Fisheries that the SMP creates a hazard for whales and therefore this department should also take responsibility for ensuring that disentanglement teams are sufficiently resourced.

Recommendation 7: The SCCG supports the recommendation of the Review paper to "increase the number of disentanglement teams along the east coast of Australia, including in the region of the SMP" (page 11). The SCCG recommends that NPWS be adequately staffed in order to respond to all emergencies under its jurisdiction, including large whale entanglements, without risk of exhaustion to staff. DPI Fisheries should also take greater responsibility for ensuring that there are an adequate number of disentanglement teams to respond to any incident along the extent of the SMP area. However in the event that state environment agencies continue to be under-resourced the SCCG suggests that LWD teams could consist of NPWS staff, Fisheries staff, and trained volunteers supported by state agencies with the supply of boats, fuel, disentanglement gear, insurance and other resources.

Recommendation 8: The SCCG recommends the use of early detection devices on SMP nets to detect the entanglement of large animals and reduce the time taken to alert and mobilise the Large Whale Disentanglement Team.

Recommendation 9: The SCCG supports the recommendation in the Review for further research into the efficacy of cetacean alarms or 'pingers' in deterring cetaceans from approaching SMP nets. The SCCG also supports the precautionary approach recommended in the Review to continue the use of cetacean alarms on SMP nets until such research is complete or viable alternatives are available. However, the SCCG also recommends that additional research is conducted into any possible negative effects of such alarms. The SCCG further recommends research into additional non-harmful methods of deterring marine mammals and other non-target species from entering SMP nets.

Recommendation 10: The SCCG recommends a reduction in the number of days that SMP nets are deployed to reduce the overlap between meshing days and the whale migration season. See also Recommendations 12 and 13.

2.5 Proposed changes to the trigger for entanglements of non-target species and threatened species

As preface to the following comments, reference is again made to concerns regarding the ongoing destructive impact of the SMP on non-target species, particularly (but not restricted to) threatened and migratory species (see General Comments).

The Review paper recommends a change from the current trigger which is:

"*Entanglements of non-target species and Threatened Species over 2 consecutive meshing seasons exceed twice the annual average catch of the preceding 10 years for those species*" (NSW Department of Primary Industries, 2009).

To a proposed new set of triggers tailored to different categories of non-target species, as below:

- *"Entanglements of Endangered or Critically Endangered species, populations or ecological communities in a single meshing season exceed the annual average catch plus two standard deviations of the preceding 10 years for those species;*

- *Entanglements of Vulnerable species or ecological communities in a single meshing season exceed the annual average catch plus three standard deviations of the preceding 10 years for those species;*

- *Entanglements of other non-target species over 2 consecutive meshing seasons exceed twice the annual average catch of the preceding 10 years for those species*" (Review page 16).

The Review states that this proposed change is in response to "consistent" criticism from the NSW Scientific Committee and Fisheries Scientific Committee that the

trigger points "*lacked a scientific basis when they were set in 2009; only consider increased catches; are not sensitive to the population parameters of the species; and do not consider the different listing status of the affected species*" (Review page 15).

The NSW Scientific Committee and Fisheries Scientific Committee have, on multiple occasions, made the reasonable request that the triggers for catch of non-target species be scientifically robust, biologically meaningful and sensitive to the population parameters of the species (Eldridge, 2015). The statement in the Review paper that "*the trigger points are an adaptive management and reporting tool, they are not and were not intended to be a scientific monitoring tool or program*" (page 15) is not an acceptable response to these requests. If the triggers are intended to be an adaptive management tool, they should be based on relevant species management parameters. Even more importantly, if an adaptive management trigger is activated, this should result in some change to the management activity (the activity in this case being a cull by netting), not just the preparation of a report or a proposed change to the trigger.

However, we acknowledge that the Review authors have responded in part to the recommendations of the two Scientific Committees and are suggesting what they believe to be an improvement to this trigger. The authors raise their own concerns with the suggested new trigger, pointing out that standard deviations "*generally rely on large numbers of data points to retain any statistical certainty or rigour, which is not what is experienced with the very low catch rates of threatened species in the SMP, suggesting they have limited utility in the trigger point process*" (page 15).

In the time available, the SCCG sought but was not able to obtain independent scientific advice as to whether the proposed changes to this trigger are likely to result in better or worse outcomes for threatened and non-target species.

It is concerning that the proposed new trigger for Vulnerable species would be less sensitive to Humpback Whale entanglements. Humpback Whale numbers are still recovering from decades of commercial whaling (Australian Government Department of the Environment, 2016). The implication that, under the proposed new trigger, the entanglement of three Humpback whales over two years and the subsequent death of one of those whales would be considered 'acceptable' is not supported by the SCCG and is not likely to be supported by the general public.

Recommendation 11: The SCCG recommends that, as a bare minimum, DPI Fisheries must seek independent peer review of the proposed changes to the trigger relating to the catch of non-target and threatened species from individuals or agencies with expert knowledge of the species concerned and statistical analysis. This expertise may be obtained via the NSW Scientific Committee, the Fisheries Scientific Committee, the relevant Recovery Teams or national or international academics or other experts.

Our preference, however, is for a more comprehensive review of the trigger points, including the trigger relating to non-target and threatened species. The SCCG supports the recommendation from Manly Council that the various statistical analysis techniques for analysing data with a large number of zeros (such as Zero-Inflated

Poisson Regression, Intermittent Demand Analysis or Sparse Data Analysis) should be investigated to determine if they provide clearer insights into the catch data and if they may inform appropriate trigger values to be incorporated into the SMP and JMA.

The SCCG also strongly supports the recommendation of the NSW Scientific Committee that trigger points should be sensitive to the population parameters of each particular species, and take into account "population size, demographic structure, breeding biology and the cumulative effect of other anthropogenic sources of mortality affecting each non-target and threatened species that interacts with the SMP" (Eldridge, 2015). This requires triggers to be determined on a species-by-species basis, an achievable aim and one that should result in improved risk management for each threatened species.

2.6 Reduction of the time period of the SMP

Under the current program, 51 beaches in NSW are fitted with shark nets that entangle both target and non-target species for eight months of the year, from the 1st of September to the 30th of the following April.

The SCCG strongly supports all efforts to reduce the catch rate and deaths of non-target species, particularly threatened and migratory species, and recommends that the program move towards better alternatives and the replacement of meshing with non-lethal shark deterrent devices.

In the interim, we recommend a reduction in the number of days that beaches are netted.

September

The Review paper provides considerable arguments in favour of the removal of the month of September from the SMP, including the following statements:

"Statistical analysis of the past 15 years of catch data indicates that removal of nets for the month of September reduces the proportion of average captured animals significantly more than 12.5% for four species: Greynurse Shark, Broadnose Sevengill Shark, Port Jackson Shark and seals" (page 17);

"In absolute numbers, removal of nets for the month of September could potentially (but not significantly) reduce the annual capture of White Sharks by an average of less than three; dolphins by an average of one individual; and on average one turtle every two years and one whale every eight years" (page 18);

"two species, Bull Shark and Dugong, have not been caught in September over the last 15 years, and that September represents:

- *less than 25% of entanglements for three other target species and four other non-target species;*
- *25-50% of entanglements for seven species or groups, three of which are TEPs and the White Shark which is both a TEP and target species;*
- *more than 50% of entanglements for one group, seals, of which there only a total of five animals caught over the last 15 years;*
- *the highest proportion of the catch of target sharks; and*

- *the second highest proportion of catches of non-target species or groups*" (page 18);

"*Of the approximately 255 unprovoked shark interactions reported in all NSW waters since 1900, almost 80% were reported over the summer and autumn months from December - April (Table 6). Eight interactions were reported for the month of September, seven of which occurred north of Port Macquarie and the other at Jervis Bay*" (page 23);

"*For the majority of target species, it appears on the basis of this qualitative assessment of unprovoked interactions that there is no impediment to removing September*" (page 38);

"*For… five target species* (Bull Sharks, Tiger Sharks, whalers, Shortfin Makos, and Broadnose Sevengill sharks), *noting that Broadnose Sevengill Sharks and Shortfin Makos should be considered for removal from the list of target species for the SMP, it appears that based on relative catch in September that there is no impediment to removing September*" (page 38).

"*Removing September appears to have little impact on bather safety with respect to the majority of target species, however there remains considerable uncertainty about White Sharks and the associated potential risk they pose to bather safety*" (page 38).

Regarding this last statement, it is not clear what evidence justifies this cautious approach to the potential risk posed to bathers by White Sharks during the month of September. Despite the fact that White Sharks are present year round at SMP beaches and in high abundances in nursery areas north of Newcastle, there have been no reported unprovoked interactions with White Sharks within nursery areas, nor an increase in the number of interactions at other beaches during periods of high juvenile White Shark abundance, and that Bruce and Bradford (2012) suggest that the presence alone of juvenile White Sharks is not a good indicator of risk.

Further, as previously stated, the whale migration season lasts from mid-May until the end of November (NSW National Parks and Wildlife Service, n.d.) and there is evidence to suggest that the season for Humpback Whales may be extending as their numbers increase (McDonald, 2015). The SCCG recommends a reduction in the number of days that SMP nets are deployed to reduce the overlap between meshing days and the whale migration season (see Recommendation 10).

Therefore for the reasons stated above, the SCCG recommends the removal of the month of September from the Shark Meshing Program.

March

The Review paper states that the "*statistical analyses for turtles as a group indicated: significant increases in catch in recent years; significant catches in March; and significantly more caught in Sydney South (43%) and Sydney Central (34%) regions*" (page 34).

All species of marine turtle are listed as threatened worldwide. Turtle species caught in SMP nets include the Green Turtle, listed as Vulnerable in NSW and Endangered by the IUCN, Leatherback Turtle (Endangered in NSW, Vulnerable under IUCN) and Loggerhead Turtle (Endangered in NSW, Vulnerable under IUCN).

Despite the evidence cited that the southern Great Barrier Reef Green Turtle nesting population (of which the NSW population is a small component) appears to be showing a slow increase in numbers (an average of about 3% per year over 4 decades) (Limpus et al 2013) the global population trend of this, and the other two turtle species affected by the SMP, is still declining (IUCN, n.d.).

Marine turtles are affected by multiple threatening processes (see Section 2.8 Cumulative impacts and false comparisons), and all species found in NSW waters are protected by NSW and Commonwealth legislation. Any additional anthropogenic causes of mortality are concerning and should be actively reduced or eliminated.

The SCCG therefore recommends the removal of March from the SMP, as the month of highest turtle catch rate. The SCCG further recommends research into what strategies, actions or tools can be implemented to reduce the number of turtle entanglements in SMP nets.

April

The Review document states that "*there have also been only two interactions* (with White Sharks) *in the autumn months of April and May, a time of year when the waters would generally still be above 20°C and theoretically would therefore be more popular for bathers during Easter holidays than in September, hence increasing the potential chances of an interaction*" (page 33).

Of the 255 unprovoked shark interactions reported in all NSW waters since 1900, 27 interactions or less than 10% of the total were reported during the month of April (Review, Table 6, page 23). Three of these were from Bull Sharks, only one of which took place in Sydney (Table 7, page 24), two from White Sharks, neither of which occurred in Sydney (Table 9, page 31) and three from Whaler sharks, two of which were in Sydney (Table 10, page 34). There have been no recorded Tiger Shark interactions in April since 1900 (Table 8, page 26).

These figures indicates a proportionally low risk to bathers from the main group of potentially dangerous sharks during the month of April. The SCCG therefore recommends that the impact of the SMP on non-target species be reduced by the removal of the month of April from the Shark Meshing Program.

Recommendation 12: The SCCG recommends that the Bather Protection Program aim towards eventual phasing out of shark meshing of beaches altogether, to be replaced with non-lethal methods of bather and surfer protection.

Recommendation 13: The SCCG recommends a reduction in the number of days that SMP nets are in the water. Specifically, the SCCG recommend the removal of the months of September, March and April from the SMP.

Recommendation 14: The SCCG further recommends research into strategies, actions and/or tools that can be implemented to reduce the number of turtle entanglements in SMP nets.

2.7 Research into beach user numbers, spatial and temporal distributions

The Review states:

"Unfortunately, robust monthly estimates of beach visitation and shark interactions across NSW are currently not available and continue to hamper any reliable assessment of the likelihood of a shark-human interaction at NSW beaches" (page 32), and

"Despite some informal recording of bather numbers during summer by some lifesaving groups, there is no consistent and systematic data collection process across NSW beaches. It has been identified in the reviews of annual performance reports as an ongoing deficiency of the research and monitoring program of the SMP, and remains an issue that needs to be addressed before the next 5-year review" (page 37).

Recommendation 15: The SCCG agrees with the Review paper's recommendation that more data is required on the number of people using SMP and non-SMP beaches, their spatial and temporal distribution, and the activities that beach users undertake along the NSW coastline. The SCCG further recommends that this research also include harbour and estuary beaches for a full assessment of the number of people using non-inland waters and a better understanding of the risks to bathers, surfers, fishers and other users of these waters.

2.8 Cumulative impact and false comparisons

The Review paper relies at least twice on a comparison of the negative impact of the SMP's catch of non-target species with other sources of anthropogenic mortality for those species to imply that the impact of the SMP can be considered negligible:

"The species or groups with relatively higher rates are all sharks or rays that are harvested by commercial and recreational fisheries and those harvest rates would exceed that of the SMP by at least an order of magnitude. Assuming the worst case scenario and that all animals entangled and released alive do not survive, the SMP still affects only a limited number of TEP animals on an annual basis. Potentially reducing that number further by removing September would therefore appear to be of little or no biological significance to their population status" (page 23-24).

"Adjusting the historical NSW SMP catches into an 8 month meshing season to be more comparable with recent catches equates to approximately 1 turtle per year, which is approximately a third of the recent average catch. By comparison, the highest recorded mortalities for Green Turtles off Queensland from reported anthropogenic sources are, on average, 50/year due to boat strike and propeller cuts, and 20/year due to entanglement in crab pot float lines (Limpus et al 2013)" (page 35).

These comparisons at best ignore, and at worst, attempt to deliberately obscure, the cumulative impact of multiple anthropogenic sources of mortality. They are, in fact, examples of a fallacy of relative privation: an attempt to diminish the seriousness of a problem by drawing attention to other, bigger problems. It is true that turtles, sharks and rays suffer extensive mortality from deliberate harvest (either legal or

illegal, unregulated, unreported harvest, or both), boat strike, accidental catch in other non-SMP-fishing gear, and, in the case of turtles, loss of habitat to coastal development and sea level rise and additional impacts such as rising temperatures skewing the gender distribution. However, this in no way justifies allowing the continued impact of the SMP on these species but in fact provides additional rationale for reducing the impacts of the SMP.

2.9 Definitions of target and non-target species

Recommendation 16: The SCCG supports the Review's recommendation that Broadnose Sevengill Sharks and Shortfin Makos be removed from the list of target sharks for the SMP. The SCCG also recommends a review of the full list of target species, clearly articulating the level of risk from each species, to ensure that the non-target catch is accurately represented and to assist in the development of more specific measures for reducing the risk from a reviewed list of target species.

2.10 Observer Program

The SCCG are strongly supportive of the Observer Program and believe that it plays an important role in the operation of the SMP. The SCCG are concerned about the decline in funding for the Observer Program and that, for example, Observers were present on only 29% of the net checks in 2013-14 (Eldridge, 2015). This is not an acceptable level of observance of the program.

In addition, the SCCG requests information on the following:

Q2.10.1 What training or qualifications are required to become a qualified Observer? These should be specified in the JMA.

Recommendation 17: The SCCG recommends that the Observer Program be adequately funded and staffed. A minimum acceptable number of hours or percentage of net checks attended by Observers should be set and stated clearly in the JMA. A new Trigger should be added to the JMA, stating that non-compliance with the acceptable minimum triggers a review into why the acceptable minimum was not kept and a requirement to address any determined shortfalls in funding or other resources.

The Observer Program should also be bolstered by GPS tracking and video monitoring on every contractor boat to capture precise information on boat routes, number of net checks and to verify catch reports provided by the contractors, on occasions when human observers are not on board. Further, each individual net should be fitted with a GPS locator device to collect precise information on how many days each net is in the water and to ensure contractor compliance with the terms of the Management Plan.

Recommendation 18: Ongoing and improved links between the Observer Program and the Australian Museum are recommended to ensure that maximum long-term scientific value is achieved through the permanent archiving of specimens and/or

biological samples of entangled vertebrates, and that specimens, samples and data obtained via the Shark Meshing Program can be made available to academic institutions and other research organisations.

Section 3. Comments relating to the DRAFT Joint Management Agreement and DRAFT Management Plan for the NSW Shark Meshing (Bather Protection) Program Public Exhibition Document January 2016

N.B. Most comments provided in Section 1 relating to the Review document also apply to the Draft Joint Management Agreement and Draft Management Plan for the NSW Shark Meshing (Bather Protection) Program Public Exhibition Document (hereafter referred to as the 'Draft Management Plan', and therefore are not repeated here.

3.1 Fishing gear specifications

The dimensions and material of the nets deployed under the SMP are described in Table 2 of the Draft Management Plan (page 9). This table specifies a mesh size of 60cm. It is noted in the Review paper that SMP nets have caught both large and small individuals of some species, including two Shortfin Mako pups (50 and 80cm sharks), and that the size range of Mako sharks caught in the SMP is "*skewed to represent primarily juvenile individuals*" which represent 85% of the catch for this species (Review page 25).

The SCCG requests information on the following questions:

Q3.1.1 What evidence (e.g. mesh selectivity curves) is available to show that the dimensions of the shark mesh nets are appropriate for catching target species of sharks within a size range considered to be dangerous to humans?

The SCCG is also concerned about the numbers of non-target, bottom-dwelling species of sharks, rays and other fauna caught by the SMP, as well as the potential damage caused by SMP nets to benthic habitats.

Recommendation 19: The SCCG recommends that appropriate mesh size and other gear specifications be determined, based on evidence such as mesh selectivity curves, to reduce the catch of small and juvenile individuals, particularly of non-target species.

Recommendation 20: The SCCG recommends that if nets are used, they continue to be set so that the top edge of the net is at least 6 metres below the surface of the water, to reduce the likelihood of marine mammal entanglements, and that they also be suspended in the water column so that the bottom edge of the net is at least 1 metre off the sea floor, to reduce the number of entanglements of bottom-

dwelling fauna and to reduce the damage to kelp forests and other benthic habitats.

3.2 Release protocols

Animals caught in SMP nets should be released as swiftly as possible and with the least possible harm.

Recommendation 21: The SCCG recommends that, if cutting the net to release animals is not currently an endorsed release technique it should be immediately added to the release protocols, and used as often as necessary to efficiently remove all animals from the net.

3.3 Proposed change to frequency of use of the SMP

The SCCG understands that the existing "frequency of use" restriction on the timing of the SMP is (in brief), 12 weekdays per month plus all weekends during the meshing period of 1 September – 30 April (NSW Department of Primary Industries, 2009 and NSW Department of Primary Industries, 2016).

The January 2016 Draft Management Plan appears to propose simplifying this restriction for the benefit of the contractors, to "23.5 Nets must be set on the first day of the Meshing Season and the Nets must be Hauled on the last day of the Season" (Draft Management Plan, page 10). The justification for this change is given on pages 43-44 of the Review document as simplifying the contractual arrangements to align with the fact that "*All but one of the Contractors had always operated that way*" (Review page 44).

This raises substantial concern that contract specifications/methodologies have not been adhered to in the past, and that DPI do not have an accurate knowledge of the actions of the contractors, or, as a result, of the level of fishing effort that has been deployed by the SMP to date. It again highlights the importance of the Observer Program, and the risks inherent in Observers only being present on a small percentage of net checks. There must be adequate observation of contractors operating within the SMP and compliance with the terms of the Management Plan must be enforced (see Recommendation 17).

The SCCG requests clarification on the following points:

Q3.3.1. What level of confidence is there that current and proposed triggers are appropriate, if these have been set based on an unknown level of fishing effort? Please provide evidence to clarify this point.

Q3.3.2 Does DPI expect that the proposed change to the frequency of use restriction will result in an overall increase, decrease, or no significant change in fishing effort? Does DPI have the ability to determine any change in the fishing effort, if the actions of contractors and the resulting number of meshing days has been inaccurately recorded to date?

The SCCG is concerned that this proposed change to the frequency of use may result in an increase in fishing effort of the SMP, as it may result in an increase in the total number of days that beaches are meshed over the meshing season.

Recommendation 22: There should be no increase in the current fishing effort of the SMP through an increase in the number of meshed days or an increase in the number of meshed beaches. Rather, the SCCG strongly recommends that there is a reduction in the number of meshing days per season (see Recommendations 10, 12 and 13).

If the change in frequency of use as proposed in the Draft Management Plan and Review document is adopted, this must be closely monitored and any increase or decrease in the total number of meshing days per year added to publicly available annual reports. The annual reports must also contain an analysis of whether the change in the total number of meshing days has resulted in any changes to the number of individuals of target and non-target species caught in SMP nets.

Conclusion

The SCCG are thankful for this opportunity to provide comment to the five year review of the Joint Management Agreements for the NSW Shark Meshing (Bather Protection) Program.

SCCG Member Councils share a strong interest in reducing the risk of violent shark encounters whilst minimising harm to marine animals and the marine environment. The management of sharks requires a delicate balance between maintaining public safety and providing for the conservation of threatened, protected and non-target species.

The SCCG formally requests that all questions and recommendations presented in this submission are considered, and that specific feedback is provided via a publically available analysis report detailing all submissions received and the Department's responses to each point.

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Appendix 1: Sydney Coastal Councils Group submission to the Inquiry into management of sharks in NSW waters, October 2015

SYDNEY COASTAL COUNCILS GROUP INC.

councils **caring for the coastal environment**

SUBMISSION

Inquiry into management of sharks in NSW waters

October 2015

090-15EN

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Introduction

Established in 1989, the Sydney Coastal Councils Group (SCCG) is a co-operative organisation that advances sustainable management of Sydney's urban coastal environment, with twenty-five years' experience in leading sustainable coastal management. The SCCG comprises fifteen Member Councils who represent over 1.4 million Sydneysiders, and is the peak NSW ROC representing coastal councils and the third largest based upon population.[1]

Our Member Councils share a strong interest in mitigating shark encounters whilst minimising harm to marine animals and the marine environment. The management of sharks requires a delicate balance between maintaining public safety and providing for the conservation of a protected species. As such, the issue must be considered in the broader context of sustainable marine management. We have had a long and involved history in this area. We were strong advocates for the establishment of Intertidal Protected Areas and we formed part of the expert panel assessing and declaring Sydney's aquatic reserves. We also collaborated with the team behind Underwater Earth to produce Underwater Sydney, an educational website that uses the latest technology to document and share Sydney's diverse marine life, including various shark species.

We welcome the opportunity to contribute to the Inquiry. Our submission provides general comments in relation to shark management and then specific comments on the Terms of Reference for the Inquiry, namely:

1. The impact of shark attacks on tourism and related industries
2. Changes in shark numbers, behaviour and habitat
3. Adequacy of management strategies
4. Measures to prevent attacks by sharks, including strategies adopted in other jurisdictions.

1 General Comments

We acknowledge that the management of sharks is a sensitive and politically charged issue, particularly given the recent spate of shark encounters in NSW waters. Whilst rare, encounters with sharks can be extremely traumatic for those affected. A whole-of-government approach to shark management is needed to balance conservation and public safety in the broader context of sustainable marine management. This should involve all levels of government (local, state and federal) and provide for effective and meaningful community engagement. It is also critically important that sufficient and long-term resourcing is allocated to relevant agencies in managing recreational water-based activities and the potential interaction with sharks and other marine species.

According to the International Union for the Conservation of Nature (IUCN), a quarter of the world's sharks and rays are threatened with extinction.[2] Sharks are an inherently vulnerable species due to their relatively long life expectancies, the time taken to reach sexual maturity and their low fertility rates.[3] These figures are all the more concerning since sharks play a critically important role in the marine ecosystem as 'apex predators'. Changes in their population and distribution have corollary impacts on other marine species and may disrupt the marine ecosystem as a whole. It is therefore important that any shark management strategies consider the role of sharks in the ecosystem, and that the Federal Government play

[1] Gooding, A 2012, *A Comparative Analysis of Regional Organisations of Councils in NSW and Western Australia*, Australian Centre of Excellence for Local Government, University of Technology Sydney.
[2] International Union for the Conservation of Nature (IUCN) 2014, 'A quarter of sharks and rays threatened with extinction' *News Story 21 January 2014*, < http://www.iucn.org/?14311/A-quarter-sharks-and-rays-threatened-with-extinction>
[3] Department of the Environment 2015, *Sharks in Australian Waters*, <https://www.environment.gov.au/marine/marine-species/sharks>

a leadership role in responding to issues and concerns. The Federal Government is also best-placed to broker international engagement in the development of management measures to ensure global conservation of shark species.

Recommendations

1.1 Promote a whole-of-government approach to shark management to balance conservation and public safety in the broader context of sustainable marine management.

1.2 Allocate sufficient and long-term resourcing to relevant agencies for implementation of management strategies.

1.3 Call upon the Federal Government to play a leadership role in coordinating a whole-of-government response and brokering international engagement on the issue.

2 The impact of shark attacks on tourism and related industries

It is important that the incidence of shark encounters is considered in the context of increasing beach visitation and recreation. Throughout Australia there is a trend of population growth, increasing beach visitation, a rise in the popularity of water-based recreational activities and people accessing previously isolated coastal areas.[4] For example, Surf Life Saving Australia recorded a 20 per cent increase in beach visitation between 2008 and 2009 alone.[5] These trends may have given rise to an increase in shark encounters as well as a perceived increase in risk of shark attack. However, at this stage, there is no concrete evidence that sharks are impacting on tourism and related industries. Nonetheless, the perceived risk of shark attack may have the potential to adversely impact on Australia's tourism industry in the short-term.

It is important that educational materials appropriately target tourists and visitors who may be less familiar with the risks of shark encounters. For this reason, tourism bodies and related industries should be engaged in the development of ethical and appropriate management strategies.

Recommendations

2.1 Engage tourism bodies and affected industries in the development of ethical and appropriate management strategies.

2.2 Ensure educational materials appropriately target tourists and visitors.

3 Changes in shark numbers, behaviour and habitat

Despite large research efforts, both locally and internationally, there is still a great deal of uncertainty about shark numbers, behaviour and habitat. It also appears that some management strategies are contrary to, or not informed by, the best available information. As such, a review of existing local and international research should be undertaken to inform appropriate management strategies and identify research gaps.

New research efforts should focus on the behaviours and movements of target species so that tailored management efforts can be developed - namely for the White Shark, Tiger Shark and Bull Shark. Further research into how environmental factors influence shark numbers and behaviour is also needed. For example, consideration of how sharks respond to changes in water quality and water temperature may assist with predicting their movements. The east

[4] West, J G 2011, 'Changing patterns of shark attacks in Australian waters', *Marine and Freshwater Research*, vol. 62, p. 744.
[5] Surf Life Saving Australia 2010, 'An Update on beach and aquatic safety', *Beachsafe Newsletter*, Issue 17.

coast of Australia is currently experiencing unseasonably warm waters and, with increasing climate variability, such trends may increase in the future. Understanding how such changes affect the abundance and distribution of different shark species and their prey may assist with predicting their movements.

Recommendations

3.1 Undertake a review of existing local and international research to inform appropriate management strategies and identify research gaps.

3.2 Focus new research efforts on the behaviours and movements of target species so that tailored management efforts can be developed.

3.3 Support further research into how environmental factors, such changes in water quality and temperature, influence shark numbers and behaviour.

4 Adequacy of management strategies

There are a suite of management strategies currently deployed to mitigate the risk of shark encounters in NSW and Australia. These include deterrence measures, detection measures, monitoring and research, and community education. Increasing research into the impacts of these strategies assists in understanding their effectiveness, however it is difficult to draw conclusive evidence and there are legitimate concerns about the environmental impacts of certain strategies.

Of particular concern are the adverse impacts of the NSW Shark Meshing Program (SMP). The SMP is a key deterrence method employed by the NSW Government to discourage sharks from aggregating near beaches. Since the Program was introduced in Sydney in 1937, there has only been one fatality due to shark bite on a meshed beach.[6] However the SMP is responsible for the often fatal entanglement of sharks and other marine life. In 2014-15, 189 marine animals were entangled in the nets.[7] A large majority of those (77%) were non-target species and over 60% died as a result of the entanglement.[8] Of those killed, 23 were protected or threatened species, including turtles, sharks and dolphins.[9] We acknowledge the need to ensure public safety at our beaches, however we are deeply concerned about the detrimental impacts that shark meshing is having on a range of marine life, particularly critically endangered, threatened and migratory species. As such, we support the trial of alternative deterrence measures, as discussed in section 5 below.

We also note that current management strategies and research efforts are heavily focused on open beaches, with less consideration of harbour and estuarine waterways. As recreation in harbour and estuarine waters increases, a renewed focus is needed to tailor management efforts and educational materials in these areas. A common measure currently used is the installation of permanent 'exclusion nets' on harbour beaches. Councils have been proactive in the management of these nets to minimise impacts on other marine species. In some cases, the nets provide habitat for other marine life, including seahorses, as is the case in Manly, Mosman and Woollahra. In this instance there is an expectation for Councils to take on the responsibility of protecting marine life on nets that have become artificial habitat, whilst maintaining nets for the purpose of reducing risks to swimmers. This is despite the nets being outside of the jurisdiction of Local Government (Councils' jurisdiction ends at the mean high

[6] http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/357438/nsw-shark-meshing-bather-protection-program.pdf
[7] NSW Department of Primary Industries 2015, *Shark Meshing (Bather Protection) Program 2014-15 Annual Performance Report*, p. 19.
[8] Ibid.
[9] Ibid.

water mark). As such, greater resourcing and coordination between Local and State Governments is needed to support their ongoing maintenance.

Education also remains an important management strategy. The NSW SharkSmart initiative provides simple and targeted information for bathers and other water users to minimise their risk of attack. The availability of the SharkSmart application for mobile devices has greatly improved the accessibility of information and the NSW Government should continue to explore the use of other social media channels to aid ongoing dissemination. It is also important that communication is targeted to different user groups (e.g. surfers, divers, swimmers), as their activities expose them to different kinds of risk. In this regard, Local Government is well-positioned to engage with their local communities and the NSW Government should support further engagement with Councils to deliver consistent messaging that is appropriately targeted to local communities and user groups.

Recommendations:

4.1 Trial alternative deterrence measures that minimise impacts on marine life.

4.2 Tailor new management strategies and educational materials for harbour and estuarine waterways.

4.3 Facilitate greater resourcing and coordination between Local and State Governments to support the ongoing maintenance of exclusion nets in harbour and estuarine areas.

4.4 Continue to explore the use of social media to disseminate information to bathers and other water users on minimising the risk of shark attack.

4.5 Support further engagement with Councils to deliver consistent messaging that is appropriately targeted to local communities and user groups.

5 Measures to prevent attacks by sharks, including strategies adopted in other jurisdictions

We support the NSW Government's current review into existing and emerging technology alternatives to lethal shark mitigation measures. We recommend trials be undertaken on a regional basis to include current meshed areas, non-meshed areas and control sites at *both* coastal and estuarine locations. It is important that a scientifically valid number of beaches inside and outside of the meshing program zone are included in the trial. We also recommend that the trial review outcomes from the 2006 Scientific Shark Protection Summit, particularly those recommendations that have not yet been actioned.

There are a number of emerging technologies that have the potential to reduce the risk of shark attack while minimising harm to marine life. Examples include the Eco Shark barrier – a large 300mx100m fully enclosed barrier that may be deployed on surf beaches – and the Clever Buoy – developed by Optus and Google Plus using fish finder sonar technology and facial recognition software to detect sharks in the area and send a real time message via satellite to lifeguards. We also support and encourage further investigation and investment by both government and commercial partners in personal protection devices. These should focus on the needs of surfers and divers who use waters outside traditional bathing locations such as headlands and more remote areas. Investigation of such alternatives should be included in the trial.

We also support ongoing research and monitoring of shark movements. We note the CSIRO is currently researching White Sharks to establish a baseline estimate of population in Australian waters. A national monitoring strategy will also be developed, enabling population estimates to be refined over time, and the work will contribute to the assessment of other conservation-

dependent species. Such research is vital to understanding more about the behaviour of these species and developing evidence-based management strategies.

Through all of this work, we believe that a partnership between Local, State and Federal Governments is fundamental. It is equally important that the community is appropriately engaged in decision-making processes. Councils can assist to broker community participation in this regard, however it is important that there is greater transparency in the nature of risks, scientific research and direct and indirect impacts of different mitigation strategies.

Recommendations

5.1 Trials of non-lethal shark mitigation measures be undertaken on a regional basis to include current meshed areas, non-meshed areas and control sites at both coastal and estuarine locations.

5.2 Review outcomes from the 2006 Scientific Shark Protection Summit, particularly those recommendations that have not yet been actioned.

5.3 Future management strategies be developed in partnership with Local, State and Federal Governments.

5.4 Enhance transparency in the nature of risks, scientific research and direct and indirect impacts of mitigation strategies to inform community engagement in future decision-making.

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