The impact of the Queensland Shark Control Program on local populations of threatened shark species, 1962-2014

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The impact of the Queensland Shark Control Program on local populations of threatened shark species, 1962-2014

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ISP Ethics Review

(Note: Each AD must complete, sign, and submit this form for every student’s ISP.)

The ISP paper by Carolyn Pushaw (student) does/does not* conform to the Human Subjects Review approval from the Local Review Board, the ethical standards of the local community, and the ethical and academic standards outlined in the SIT student and faculty handbooks.

*This paper does not conform to standards for the following reasons:

Completed by: Tony Cummings

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Signature:

Program: Australia: Rainforest, Reef, and Cultural Ecology

Date: December 4, 2015
Abstract

Since 1962, the Queensland government has employed a shark control program consisting of shark nets and drum lines off the coast of popular beaches. This program is intended to protect beachgoers from shark interactions by fishing down local shark populations, reasoning that the fewer “large sharks that are present, all things being equal, the less chance of an attack occurring” (McPhee, 2012). In the current study, trends in Queensland Shark Control Program (QSCP) catch between 1962-2014 are examined for select threatened shark species; namely, *Carcharodon carcharias*, *Carcharias taurus*, and *Sphyrna* spp. For all focus species, significant and consistent temporal declines in catch rates were observed since the 1970s. Overall, a majority of sharks were caught on nets rather than drum lines. Most of these individuals were juveniles, based on recorded length frequencies. Monthly catch trends for each species varied, reflecting differences in their biology. The present study also provides information on change in fishing effort of the QSCP since 1962, and how effort related to catch rates of the focus species at each location under the shark control program. The results of this study indicate that the Queensland Shark Control Program may have a serious negative impact on local populations of threatened shark species. These findings corroborate past research on shark control programs, and provide further support for the implementation of non-lethal shark deterrents.
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Abbreviation Codes
QLD—Queensland
NSW—New South Wales
QSCP—Queensland Shark Control Program
SCP—Shark Control Program
Introduction

Although shark attacks are rare incidents that result in fewer than 10 human fatalities per year, these gruesome events attract extensive media coverage and evoke an emotional response from the public (ISAF, 2015). Due to a large coastal population and a “beach culture” that encourages water-related recreation, Australia has a relatively high rate of shark attack, averaging 1.1 fatalities per year (West, 2011). Compared to other sources of violent death, this number is extremely low; falling coconuts claim more lives than sharks every year (Onion, 2015). However, media portrayals of sharks as “man-eaters” have led to widespread fear of sharks, resulting in skewed risk assessments by many beachgoers.

To minimize the perceived danger to swimmers and surfers, many countries where shark attacks occur have incorporated shark control programs (SCPs). In Australia, these programs are currently present in New South Wales and Queensland. They aim to reduce local populations of sharks in order to minimize the likelihood of human-shark interactions, reasoning that fewer sharks will result in fewer attacks (McPhee, 2012). The Queensland Shark Control Program (QSCP) targets supposedly “dangerous” sharks using a series of 369 drum lines (Fig. 1) and 30 shark nets (Fig. 2) placed at popular beaches from Cairns to the Gold Coast (Meeuwig, 2014). Government contractors check the equipment every two days to euthanize target sharks with a firearm or powerhead, and release by-catch species entangled in the gear (“Shark control equipment”, 2013).

The program was introduced in 1962 after two fatal attacks in Queensland, at a time when it was widely believed that “‘the only safe shark is a dead shark’” (Cliff and Dudley, 2011). Thus the practice of fishing down “dangerous” shark populations was implemented. Currently, the QSCP targets great white sharks, hammerhead sharks, mako sharks, bull whalers, dusky whalers, longnose whalers, pigeye whalers, sandbar whalers, sharptooth
sharks, silky whalers and tiger sharks (“Death or injury”, 2005). However, most of these species are not particularly dangerous. In fact, hammerhead sharks (*Sphyrna* spp.) are regarded as “high risk” not due to any history of attacks in Queensland, but solely because of their local abundance (“A Report”, 2006). Additionally, many of these target species are listed as “threatened” by the IUCN, including great white sharks, dusky whalers, shortfin makos, sandbar whalers, sharptooth sharks, and all species of hammerhead sharks (IUCN, 2015).

Figure 1: Detail of the Queensland Shark Control Program drum line arrangement. Source: Queensland Government Dept. of Primary Industries and Fisheries.
With most threatened shark species facing population declines worldwide, the mortality inflicted by shark control programs could be doing irreversible damage. Sharks are highly vulnerable to external population pressures due to their long life histories (Meeuwig, 2014). Therefore, research suggests that even non-commercial fishing pressure, such as shark control programs, can cause severe declines in populations of large sharks (Ferretti et al., 2010).
In the New South Wales SCP, which employs similar strategies to the QSCP, high fatality rates were observed for both target and non-target species caught in the nets and drum lines (Green et al., 2009). Assuming the same holds true in neighboring Queensland, the QSCP could be a significant anthropogenic danger to marine wildlife off the Queensland coast. This is supported by the findings of the Australian Fisheries Scientific Committee, which concluded that shark meshing was a “key threatening process” to animals (2012).

The danger posed by the QSCP to local shark populations is especially problematic considering the key role that sharks play in ocean ecosystems. Large sharks are critical to maintaining healthy ecosystems because they are “apex predators” at the top of the food chain (Meeuwig, 2014). Removing sharks from ecosystems can cause mesopredator (second-tier predator) populations to explode, resulting in trophic cascades with far-reaching consequences (Ferretti et al., 2010).

In 2014, the Queensland government made all catch data from the shark control program public in response to Sea Shepherd’s request under the Freedom of Information Act. With this data, it is now possible to begin quantifying the program’s effects on threatened shark species off the coast of Queensland.

The aim of this study was to assess the impacts of the Queensland Shark Control Program on select threatened shark species in Queensland—specifically, *Carcharodon carcharias*, *Carcharias taurus*, and *Sphyrna* spp. Although *C. taurus* is no longer targeted by the QSCP, this critically endangered species is still susceptible to injury or death in the shark control program gear as incidental by-catch. This study evaluates the hypothesis that the QSCP has been a significant source of mortality for populations of these sharks in Queensland since the program’s inception in 1962.
Methods

Data collection

The current study focuses on the available government records from the Queensland Shark Control Program (1962-2014). Contractors serviced the shark nets and drum lines every second day during this period, weather permitting, and supplied information on catches to the Queensland government. For each catch, contractors recorded species and number of individuals; area and specific location found; the animal’s length and sex; whether it was alive or dead; what equipment it was caught on; water temperature; and any relevant comments. However, many of these factors were often not recorded or were recorded inaccurately (e.g. not differentiating between species of whalers). This data was compiled into digital records, which Sea Shepherd volunteers converted into an online spreadsheet.

Data analysis

Data analyses were based on linear regression models created using Microsoft Excel and Tableau. MS Excel was used to create graphs and calculate correlation values, and Tableau was used to plot trend lines and calculate the statistical significance for each model.

Species identification

Government records show that 49 shark species have been caught in the Queensland Shark Control Program. Many of these species were not accurately identified until the early 1990s. Prior to this, species of the genus Sphyrna were all classified as “hammerhead sharks”, and many species of the genus Carcharhinus were classified as “whalers”. Additionally, any sharks the contractors were unable to identify were recorded as “unknown shark”.

Due to these variations in how species were recorded, the present study focused only on species of sharks that fulfilled two requirements: they had been consistently reported in
multiple locations in the data since 1962, and were classified as “threatened” in Australia by the IUCN as of 2015. “Threatened” is a conservation category encompassing the subcategories of “vulnerable”, “endangered”, and “critically endangered”, indicating that a species faces serious extinction risk (IUCN, 2015).

These included hammerhead sharks (Sphyrna spp.), great white sharks (Carcharodon carcharias), and grey nurse sharks (Carcharias taurus). Although C. taurus is no longer targeted by the QSCP, these sharks are still caught incidentally in the gear and often die due to their injuries before they can be released by contractors.

Because the three species of hammerhead sharks in Queensland (S. lewini, S. zygaena, and S. mokarran) are all considered “threatened”, and these species were not differentiated until the early 1990s, Sphyrna spp. were analyzed as a group. Other species were analyzed individually.

Other threatened shark species included dusky whalers, sandbar whalers, zebra sharks, and tawny sharks. However, these species were excluded from the present study because they were either not consistently present in the data prior to the 1990s (sandbar whalers and dusky whalers, due to being mislabeled as generic “whalers”) or they were considered “threatened” worldwide but “least concern” in Australia (zebra sharks and tawny sharks).

**Results**

*Annual catches of focus species*

Total annual catches of Carcharodon carcharias, Carcharias taurus, and Sphyrna spp. showed overall downward trends between 1962-2014 (Figs. 3-5). Based on the linear regression models for each graph, the relationship between time and number of sharks caught was highly significant (p<0.05) for all three species.
The $R^2$ value for the linear regression model of *C. carcharias* catch over time shows that this trend line is a good fit for the data, accounting for 60.9% of the observed variation (Table 1). The slope coefficient indicates that approximately 0.437 fewer white sharks have been caught on average each year from 1962-2014 (Table 1). This result is supported by the correlation value of -0.78, showing that there is a strong negative relationship between time and number of sharks caught (Table 1). This temporal trend is highly significant with a $p$-value of <0.0001 (Table 1).
The $R^2$ value for the linear regression model of $C. \text{taurus}$ catch over time shows that this trend line is not a good fit for the data, as it explains just 35.4% of the observed variation due to a high number of outliers in the first two decades of the program (Table 2). The slope coefficient indicates that approximately 0.213 fewer grey nurse sharks have been caught on average each year from 1962-2014 (Table 2). The correlation value of -0.58 supports this result by revealing that there is a moderate negative relationship between time and number of sharks caught (Table 2). While the model is not as strong as the $C. \text{carcharias}$ model, this temporal trend is still highly significant with a p-value of $<0.0001$ (Table 2).
The $R^2$ value for the linear regression model of *Sphyra* spp. catch over time shows that this trend line is a good fit for the data, as it accounts for 74.9% of the observed variation (Table 3). The slope coefficient shows that approximately 8.46 fewer hammerhead sharks have been caught on average each year from 1962-2014 (Table 3). This result is supported by the correlation value of -0.87, indicating the presence of a strong negative relationship between time and number of sharks caught (Table 3). Like the trend lines in the other two models, this temporal trend is highly significant with a p-value of <0.0001 (Table 3).
Length frequencies

Data on shark length was compiled in order to estimate the number of juveniles caught from each species, because length is correlated with maturity (Figs. 6-8). *Carcharodon carcharias* males mature at lengths >3.5 m, and females mature at lengths >4 m (Cliff, Dudley, and Davis, 1989). *Carcharias taurus* males mature at lengths >2 m, and females mature at lengths >2.2 m (“Carcharias taurus”, 2015). Individuals from the genus *Sphyrna* were analyzed as a group, but these sharks mature at different lengths depending on the species—between 2-2.5 m for males and 2-3 m for females (IUCN, 2015).

The given values are minimum lengths at maturity; thus, the percentages of juveniles were estimated based on the number of individuals below these cutoffs. Percentages of adults were not estimated because it is impossible to determine from the data whether sharks over the minimum length had actually reached maturity.

![Figure 6: Length distribution of *C. carcharias* individuals caught in the QSCP, 1962-2014.](image)
Measurements of *Carcharodon carcharias* length frequency reveal that the majority (74.1%) of sharks caught were between 1-3 m in length, falling below the cutoff for minimum length at maturity (3.5 m in males, 4 m in females). This indicates that primarily juvenile *C. carcharias* are caught in the Queensland Shark Control Program. Four sharks were recorded >6.5 m, larger than any previously observed *C. carcharias*, so these were considered to be contractor measurement or data entry errors and classed as “Not Measured”.

![Figure 7: Length distribution of *C. taurus* individuals caught in the QSCP, 1962-2014. A minority (27%) of *Carcharias taurus* sharks caught in the QSCP were <2 m long, which is the minimum length for maturity in males. This suggests that a minority of individuals caught from this species were juveniles. Four sharks were recorded >5 m, which is larger than this species can grow, so these were considered to be errors and grouped with “Not Measured”.

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A majority of hammerhead sharks (59.2%) were <2 m in length, which was considered to be the minimum cutoff for maturity for either sex due to the variance in length at maturity between species. This indicates that hammerhead catch in the QSCP has been composed predominantly of juveniles. One shark was recorded <0.1 m and 126 sharks were recorded >7 m, so these unrealistic figures were regarded as errors and grouped with “Not Measured”.

Catch by gear type

The QSCP deploys a total of 30 shark nets and 369 drum lines to catch marine wildlife. The two types of gear tend to catch different species, with nets generally considered to be less selective (McPhee, 2012). The number of individuals from each species caught on each type of gear was compiled (Figs. 9-11). Gear classified as “Other” was recorded in the data, but was not included in analysis as it was unclear what fell under this category.
Figure 9: The number of *C. carcharias* individuals caught in different types of QSCP gear, 1962-2014.

Figure 10: The number of *C. taurus* individuals caught in different types of QSCP gear, 1962-2014.
The majority of individuals from all focus species were found entangled in nets. This included 68.9% of total *Carcharodon carcharias* catch, 82.4% of total *Carcharias taurus* catch, and 88.5% of total *Sphyrna* spp. catch. In contrast, 29.3% of total *C. carcharias* catch, 16.4% of total *C. taurus* catch, and just 7.9% of total *Sphyrna* spp. catch were found on drum lines.

*Changes in effort*

Because there is no data available on changes in the number of nets and drum lines in the QSCP over time, the number of beaches under the QSCP was used as a proxy measurement for change in fishing effort.
Fishing effort increased sharply in the first few years of the program, with the number of “protected” beaches growing from 11 in 1962 to 35 in 1966 (Fig. 12). The program then expanded steadily until the early 1990s, when it experienced another steep increase as the number of beaches grew from 66 to 86 between 1991-1997 (Fig. 12). Following this period, the number of beaches under the program appears to have leveled off, with only one new beach added since 1997 (Fig. 10). Currently, the 87 beaches under the QSCP are found in 10 main regions, and in total contain 369 drum lines and 30 nets (Fig. 13).
A recent notable change in fishing effort occurred in 1992 and 1993, when drum lines replaced nets in many areas in an attempt to reduce by-catch ("Death or injury", 2005). However, no data could be obtained on how this policy affected the exact number of lines and nets in place.

**Catch by location**

Average annual catch of the focus species at each of the 10 main regions under the Queensland Shark Control Program was evaluated (Figs. 14-16). Across all locations, correlations were determined between two variables: average annual catch, and fishing effort in terms of the number of nets and lines used (Table 4).
Figure 14: Average catch per year of *C. carcharias* individuals at each location from 1962-2014.

Figure 15: Average catch per year of *C. taurus* individuals at each location from 1962-2014.
The highest average annual catches of *C. carcharias* occurred in the Gold Coast and the Sunshine Coast, with respective catch rates of 7.26 and 4.36 sharks per year (Fig. 14). *C. taurus* average annual catches were highest in the Sunshine Coast at 1.89 sharks per year, and the Gold Coast at 1.3 sharks per year (Fig. 15). *Sphyrna* spp. average catch rates peaked in the Gold Coast and Cairns with 64.32 and 45.92 sharks per year, respectively (Fig. 16). For all locations, moderate positive correlations were observed between average annual catch and fishing effort as represented by the total number of nets and drum lines used (Table 4).
Catch by month

Average catch by month of the focus species across all regions from 1962-2014 was calculated to assess inter-monthly variations (Figs. 17-19).

Figure 17: Average monthly catch of *C. carcharias* across all locations from 1962-2014.

Figure 18: Average monthly catch of *C. taurus* across all locations from 1962-2014.
Average monthly catches of *Carcharodon carcharias* peaked in the austral late winter and early spring, between August and October (Fig. 17). Very few individuals were caught in the summer and fall. Average monthly *Carcharias taurus* catches were more variable, with two peaks: one in the spring months (October/November) and one in May (Fig. 18). *Sphyrna* spp. monthly catches were highest in the spring and early summer months, and the lowest catches occurred in June and July (Fig. 19).

**Discussion**

*Total annual catch*

Moderate to strong negative correlations were observed between time and catch for all focus species, indicating that over time the total annual catch of each species has decreased (Tables 1-3). Additionally, the slope of the linear regression model for each species was
negative, showing that on average the rate of sharks caught per year has declined since 1962 (Tables 1-3). These temporal trends were highly significant (p<0.0001) for all species.

These results imply that another factor besides mere chance is involved in contributing to the observed trends. They support prior research showing that catch rates are generally high at the start of SCPs and subsequently decline, which is “due in part to effect of shark control programs ‘fishing down’ local populations of animals vulnerable to the gear” (McPhee, 2012). Furthermore, despite an increase in fishing effort in terms of the number of beaches under the QSCP since 1962 (Fig. 12), the total annual catch of each species has decreased steadily (Figs. 3-5). This contrast between intensified fishing effort and reduced catch numbers over time indicates that there are simply fewer sharks left to catch. It seems that the QSCP has achieved its aim to “reduce the number of potentially dangerous sharks in particular areas” (“Shark control equipment”, 2013).

Commercial shark fishing in Queensland is also a possible contributing factor to the observed decline in catch. However, *Sphyrna* spp. make up just 10.8% of the annual catch in Queensland fisheries, and *C. carcharias* and *C. taurus* were not recorded as caught by fishermen during a three year period in Queensland (Harry, 2011). Although commercial shark fishing has recently increased to the point where the industry has had to be limited to a total catch of 600 tons per year, prior to 1994 the Queensland shark fishing industry reported annual total catches of less than 295 tons (“A vulnerability assessment”, 2012). Thus commercial shark fishing does not appear to have contributed significantly to the observed decreases in shark catch under the QSCP from 1962-1994, when declines were most pronounced (Fig. 5). However, commercial shark fishing has likely had a recent negative impact on shark populations. Further studies are necessary to quantify this effect.
Length frequencies

Sharks greater than 3 m in length have been classified as potentially “dangerous to humans” (Meeuwig, 2014). Yet 88.5% of *C. taurus*, 74.1% of *C. carcharias*, and 87.5% of *Sphyrna* spp. caught in the QSCP were less than 3 m long (Figs. 6-8). Based on their smaller size, the majority of *C. carcharias* and *Sphyrna* spp. individuals caught were likely juveniles. At first glance, this appears to be a better outcome than killing sexually mature adults. However, large sharks are generally long-lived species with low reproductive rates, and thus juvenile survival is critical to maintaining and increasing populations (Otway et al., 2004). Therefore, anthropogenic threats to juvenile sharks have far-reaching implications for the long-term existence of these species.

A minority of *C. taurus* individuals caught appear to have been juveniles, which suggests that many sharks caught from this species were mature adults (Fig. 7). This is cause for concern because these sharks reproduce at a maximum rate of two pups every two years, so a decline in the breeding population would have serious repercussions (Otway et al., 2004). Due to their slow life histories, as a species they “do not appear to have the capacity to recover unless anthropogenic mortality is eliminated” (Otway et al., 2004).

Gear type and fishing effort

All focus species were caught much more frequently in nets than on drum lines (Figs. 9-11). This was unexpected, considering that nets are indiscriminate tools whereas baited drum lines are specifically designed to attract potentially dangerous sharks in the vicinity of the line (McPhee, 2012). However, other studies have shown that certain shark species, such as *Galeocerdo cuvier*, are more often caught on drum lines than nets (e.g. Sumpton et al.,
2011). The recent major change by the QSCP to replace nets with drum lines in certain areas may have a significant impact on catch rates of species that are more susceptible to drum lines (“Death or injury”, 2005).

Moderate positive correlations were observed between the amount of gear used (combined number of nets and lines) and the average annual shark catch at each location (Table 4). The Gold Coast and Sunshine Coast tended to have the highest annual catch rates of the focus species, perhaps due in part to the prevalence of nets at these locations (Fig. 13). However, Cairns exhibited the second highest rates of catch for *Sphyrna* spp., despite no nets being employed in this region (Fig. 16). This indicates that there may not be a clear relationship between the amount of QSCP gear used and the number of sharks caught. A variety of other factors are likely involved, including local shark population size, migration patterns, and temporal changes in QSCP effort.

*Monthly variation in catches*

Catches of *C. taurus* and *Sphyrna* spp. were highest during the austral spring and summer months (Fig. 18-19). Many sharks prefer warmer waters because the higher temperatures attract prey (such as baitfish) and facilitate thermoregulation, which may explain increased catch rates of these species during the summer months (Heithaus, 2001).

However, *C. carcharias* catches tended to be higher in the cooler late winter and early spring (Fig. 17). These sharks are endothermic and thus are less reliant on external heat sources to regulate their internal body temperature, so they can inhabit environments with lower water temperatures (“Shark biology”, 2015). Additionally, their prey includes sea lions, seals, and other animals that are primarily found in cold water (“Great white shark”, 2015).
The preference of *C. carcharias* for cooler water also helps explain why these sharks were almost never caught in the tropical waters north of Mackay by the QSCP (Fig. 14).

**Conclusion**

*Ecological impacts*

Due to logistical limitations on research of aquatic predators, there is little concrete data regarding population size and structure of the focus species off the Queensland coast. For example, one of the best-studied shark species in Australia is *C. taurus*, yet realistic estimates of the east coast population range from 300-3000 individuals (Otway et al., 2004). Therefore it is difficult to place the findings of the current study in context, and further research is necessary to quantify anthropogenic threats to shark populations. However, it is clear that significant declines in QSCP shark catch have been observed since the 1970s (Figs. 3-5). When taking into account the simultaneous rise in fishing effort by the QSCP, it is likely that the program has fished down local shark populations to the point where even increased effort does not yield greater returns (Fig. 12). Additionally, the QSCP primarily catches juveniles of *C. carcharias* and *Sphyrna* spp., reducing the future reproductive potential of these species and calling their long-term survival into question (Figs. 6-8).

Decreases in populations of large sharks have been shown to result in serious ecological consequences. By removing apex predators from the ocean ecosystem, shark control programs and other human-driven sources of shark mortality can cause trophic cascades with devastating results. For example, after anthropogenic pressures off the coast of North Carolina caused an 87-99% decrease in seven major shark species, mesopredators such as cownose rays became so abundant that they caused the collapse of a century-long scallop fishery (Myers et al., 2007). Additionally, sharks are vital to maintaining healthy coral reefs.
Without these apex predators to keep them in check, mesopredator populations can increase and overexploit prey sources, resulting in reduced numbers of herbivorous fish and therefore uncontrolled algal growth on reefs (Ferretti et al., 2010). The environmental cost of the QSCP is especially important for the Queensland government to consider because management of the Great Barrier Reef should be of paramount importance. It is critical to preserve biodiversity in the Great Barrier Reef not just to ensure the survival of this natural wonder, but also to support the multi-billion dollar reef tourism industry.

**Effectiveness of the QSCP**

The rarity of shark attacks and the impossibility of establishing experimental control sites makes it difficult to quantify the effectiveness of shark control programs in terms of protecting human lives. However, traditional SCPs seem to have minimal impact on human safety. Most experts argue that SCPs composed of drum lines and nets “‘don’t save lives’”, and merely provide the illusion of safety at the expense of marine animals (Hopkin, 2014).

During the 40 years prior to the establishment of the QSCP, annual fatalities from shark attacks in Queensland steadily decreased from 1.1 to 0.5—without any shark control methods in place (Meeuwig, 2014). Since the QSCP was initiated in 1962, the average number of fatalities per year has remained at approximately 0.4-0.5, indicating that the QSCP has not played a significant role in reducing shark attack fatalities (Meeuwig, 2014).

If Australia’s shark control programs were successfully preventing shark-human interactions, then a decrease in both attacks and fatalities would be expected. This is not the case: shark attacks have actually increased throughout Australia over the past four decades, while the proportion of attacks which result in fatalities have decreased (Fig. 20). The majority of shark attacks (62.4%) occurred in NSW and Queensland, where shark control
programs are employed (West, 2011). The increase in attacks is not because sharks are becoming more aggressive towards humans, but instead is most likely related to recent Australian population growth and the rising number of people participating in water-based recreation activities (West, 2011). Despite more frequent attacks, fatalities have been limited, but again this is not due to the efficacy of shark control programs. Many experts believe that the lower fatality rate is “highly unlikely to be a result of meshing activities, but is likely to be a function of improved beach front response time and first aid procedures” (McPhee, 2012).

Despite the evidence that SCPs are largely ineffective, they are popular because their presence boosts beachgoers’ feelings of confidence and safety in the water (Neff, 2012). Many swimmers mistakenly believe that the nets are designed to keep sharks out of popular beaches, and are not aware that upwards of 40% of shark catches occur on the beach side of the nets because sharks can swim over and around them (McPhee, 2012). Because the nets do
not actually enclose beaches, shark attacks have been recorded in supposedly “protected” areas (McPhee, 2012).

*Alternative shark deterrents*

Currently, a variety of more sustainable shark deterrent methods are being proposed, tested, and implemented worldwide. These alternatives range from releasing live sharks to high-tech devices, and could be gradually incorporated into the QSCP to replace outdated net and drum line configurations.

A method that has been used successfully in South Africa and Brazil involves the release of all live sharks caught in SCP gear. In KwaZulu-Natal, South Africa, the shark control program uses comparable equipment to the QSCP; however, instead of killing sharks caught in the gear, contractors tag and release them (Cliff and Dudley, 2011). Similarly, sharks off the coast of Recife, Brazil are caught using drum lines and longline fishing gear, and potentially dangerous sharks are relocated away from popular beaches (Hazin and Afonso, 2011). This represents a step in the right direction, away from the Queensland strategy of euthanizing all target sharks. However, the equipment itself creates serious risks for sharks, as it is essentially fishing gear designed to kill animals (Blair, 2015). Tiger sharks have the highest survival rates of all sharks in these catch-and-release programs, yet still suffer up to 60% mortality rates in the nets and lines (Cliff and Dudley, 2011). By-catch species fared slightly better, but more than half of all non-target animals were found dead in the SCP gear (Cliff and Dudley, 2011). Despite modifications, these traditional programs that rely on shark nets and drum lines are fundamentally dangerous to marine wildlife, and different approaches should be explored.
One simple proposal could be incorporated immediately to reduce the impact of the QSCP on marine animals. During stinger season (November-May), many North Queensland beaches employ stinger nets to minimize the risk jellyfish pose to beachgoers (“Dangerous marine life”, 2015). Because swimmers are restricted to these enclosures during the season, removal of shark nets and drum lines during stinger season would have no effect on perceived safety in the water. Seasonal removal of shark control program gear would eliminate the environmental costs associated with the QSCP in selected locations during this period. This strategy has been successfully implemented at beaches in New South Wales during the whale migration season (Reid et al., 2011) and in South Africa during the annual sardine run (Cliff and Dudley, 2011). Although this does not provide a complete solution, it could at least limit the QSCP’s environmental damage while a new long-term strategy is developed.

With recent, rapid advances in the field of shark deterrent technology, sustainable alternatives to traditional SCPs already exist. In November 2015, the New South Wales government initiated a revolutionary shark control program that will be implemented over a five-year period. The program will include aerial surveillance of sharks using drones, sonar buoys to monitor tagged sharks, and an app for beachgoers to track sharks in real time (“World-first”, 2015). Niall Blair, the NSW Minister for Primary Industries, said in an interview that shark nets and drum lines would be replaced with physical barriers that allow small animals to pass through safely and larger animals to bounce off rather than becoming entangled (2015). These barriers include new technology such as the Eco Shark Barrier, a strong, flexible nylon fence that protects beachgoers without trapping wildlife, which has been successfully trialed in Western Australia (“The product”, 2015). Blair further stated that the NSW government would commit some of the program’s $16 million budget to funding entrepreneurs who design high-tech shark deterrents (2015). Some of these innovations
include wetsuits that are patterned after poisonous sea snakes, which sharks tend to avoid, and electromagnetic shark repellent devices installed in surfboards (Pancia, 2015). This gear is based on scientific research (e.g. Smit and Peddemors, 2003) and although it has not been extensively tested is likely to reduce the possibility of human-shark interactions. Future research is necessary to verify the effectiveness of new shark deterrent technology.

Human lives are of paramount importance, and “there are no simple government solutions when sharks bite people” (Neff, 2012). However, the danger posed by sharks to humans is so insignificant that it does not justify the environmental damage inflicted by traditional shark control programs. The Queensland Shark Control Program’s system of shark nets and drum lines indiscriminately catches and kills animals in the name of making beaches “safe”. Despite a lack of scientific proof on their effectiveness in protecting people, and substantial evidence to show that the nets and lines negatively impact marine wildlife, these excessive measures have rarely been challenged. The Queensland government could pursue non-lethal shark deterrent methods to ensure that the oceans are a place where humans and sharks can coexist.
References


