

Submission to the Senate Inquiry into Shark mitigation and deterrent measures

Duncan Leadbitter

March 2017

Overview

The submission puts forward information to support the following claims and conclusions:

1. The beach meshing programs are culls designed to reduce shark numbers to an unspecified low level on regional scales of several hundreds of kilometres.
2. The recent growth in the number of culling programs carries the potential for cumulative impacts on targeted sharks and, in particular, the Great White Shark.
3. There is no publicly available assessment of the potential, cumulative impacts of the culls on the Great White Shark, which is listed under the EPBC Act. There is no estimate of what level of (non natural) mortality the shark population on the East Coast can withstand.
4. There is no evidence that culling has any measurable influence on the number of shark attacks and thus the culling may be putting sharks at risk for no benefit.
5. The Recovery Plan for the Great White Shark contains little more than a series of commitments to research and information gathering. Unlike the sorts of rigorous, accountable plans put in place to manage commercial fisheries, this vulnerable species is not protected from depletion to levels that may hinder reproductive capacity.
6. The Minister administering the EPBC Act may not be implementing Australia's commitment to implement the Law of the Sea.

Recommendations

1. Population models for the targeted species and in particular the Great White Shark should be prepared by independent scientists and used to evaluate the potential impacts of the growing number of culls;
2. The agencies administering the culls should be required to put in place, with full public consultation, the objectives for the culls. In particular, there should be a clear statement about the extent of depletion sought.
3. Agencies administering the culls should be required to demonstrate, via independently peer reviewed analyses the role of the culls in protecting waterway users.
4. Target and limit reference points should be determined for the target species. For the Great White Shark the recovery plan should be amended to ensure that these reference points are linked to clear management actions;
5. Legal academics should be asked to review the implementation of Australia's commitment to the Law of the Sea by the environment department and provide a publicly available report on progress.

My name is Duncan Leadbitter and I have had a professional involvement in fisheries management and marine conservation for about 35 years. I run my own fisheries consultancy which is involved in fisheries management primarily outside of Australia. In the past I was involved in the establishment of marine protected areas and provisions for threatened fish species in New South Wales. I also chaired a Fisheries Management Advisory Committee for the Australian Fisheries Management Authority at a time when the Harvest Management Strategy was being prepared. I am also a Visiting Fellow at the Australian National Centre for Ocean Resources and Security (ANCORS) which is part of the law school at the University of Wollongong.

1.0 Adequacy of measures under the EPBC Act to protect the Great White Shark

The Great White Shark is listed as vulnerable and migratory under the EPBC Act and is the subject of a recovery plan. The bather protection program that operates from Wollongong to Newcastle has been identified as a key threatening process but it is only one of three such programs that target white sharks now operating along the East Coast, the others being a long running program in Queensland and the new program in northern New South Wales.

1.1 Shark culling programs

According to Paxton and West (2006) 'The aim of shark meshing is simply to reduce the populations of dangerous sharks by killing them'. In South Africa it is openly acknowledged that the shark meshing program is designed to achieve localised depletion (Cliff and Dudley 1992), as quoted below:

How Do the Nets Work?

*Although incidents have continued to occur at unprotected beaches and at certain netted beaches, the number of incidents in Natal has been substantially reduced by the widespread installation of nets (Walleth 1983; Cliff 1991). The nets have reduced the number of sharks along the entire Natal coast (Davies 1963; Walleth 1983), thereby lowering the probability of a shark encountering a bather at netted or unprotected beaches. This reduction in shark numbers is shown by the rapid decline in the catch rate immediately after the installation of nets in Durban in 1952 (Davies 1964; Holden 1977) and the remainder of the Natal coast from 1966 (Walleth 1983; Cliff *et al.* 1988b) (Fig. 3). Since 1970, catch rates have remained relatively constant, and catches are now thought to be sustained by the influx of sharks from adjacent waters.*

The NSW DPI claims the program is not a cull but culling is one of the objectives documented in Green *et al* (2009) which is a key guiding document in the joint management arrangements that regulate the program. In seeking to explain the decline in catch per effort associated with mesh netting the DPI has suggested that the nets prevent the formation of territories by sharks and may also have the potential disrupt migration thus causing sharks to move to other areas.

There is no evidence of territory formation by the species targeted by the meshing program. The DPI admits that '**There is no scientific evidence that sharks aggressively defend small, localised territories.....**' (Answer to question 253 – Budget Estimates General Purpose Standing Committee No. 5) but then claims that "**The word 'territory' means different things to different people, and this is the case for sharks as well as many other animals** " and argues that a territory includes any sort of aggregation of animals be it for feeding or nursery purposes. However,

this broad approach is at variance to the commonly accepted definitions in animal ecology (see references at [https://en.wikipedia.org/wiki/Territory_\(animal\)](https://en.wikipedia.org/wiki/Territory_(animal))) where the concept of an area being defended is a key factor separating sites where animals may congregate for some reason as opposed to an area which, in the minds of most members of the community, an animal would defend from interference by others.

The Catch Per Unit Effort (a partial indicator of abundance based on catch per netting day) documents a long term decline in the numbers of sharks caught in the area subject to the meshing program (Reid et al 2011). The meshing program is termed “a pulse fishing strategy ” in a review of the Queensland program which has gear in the water all year (Anon 2006) in. It is not described as a migration disrupter by fisheries scientists.

A rational explanation for the observations of declining catches is that the meshing program is simply overfishing the sharks. Cliff and Dudley (2011) show how catches increased as more nets were added to the coast and this caused a depletion as catches exceeded the ability of the shark population to replenish itself either via local breeding or inward migration from other areas (See Figure 6).

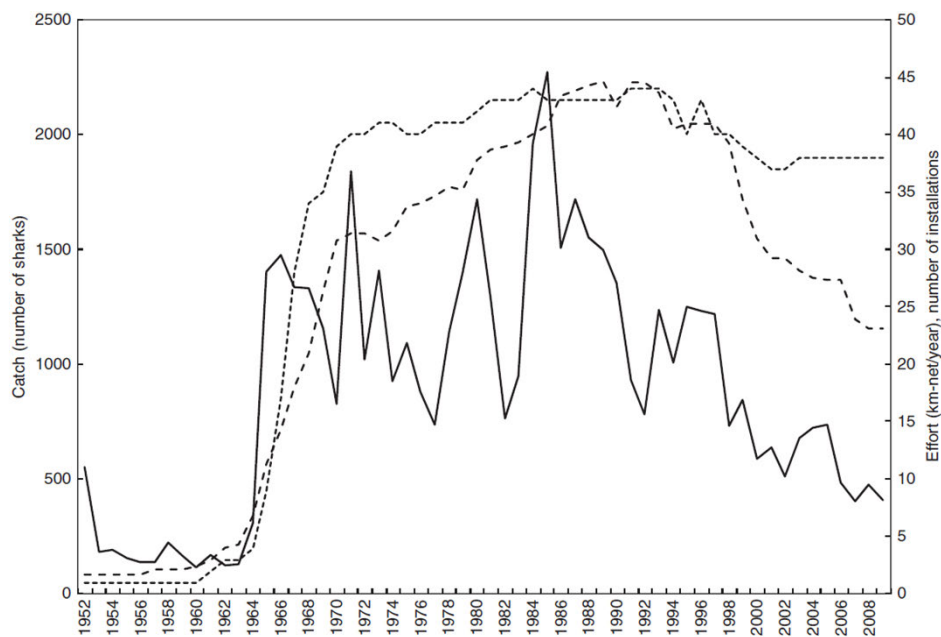


Figure 6 - Reproduced from Figure 2 (Cliff and Dudley 2011) showing total annual catch (solid line) and effort (number of installations, dotted line; kilometres of net per year, dashed line) in the KwaZulu-Natal shark control program

This graph bears a remarkable similarity to the decline in the NSW shark meshing area (Figure 7).

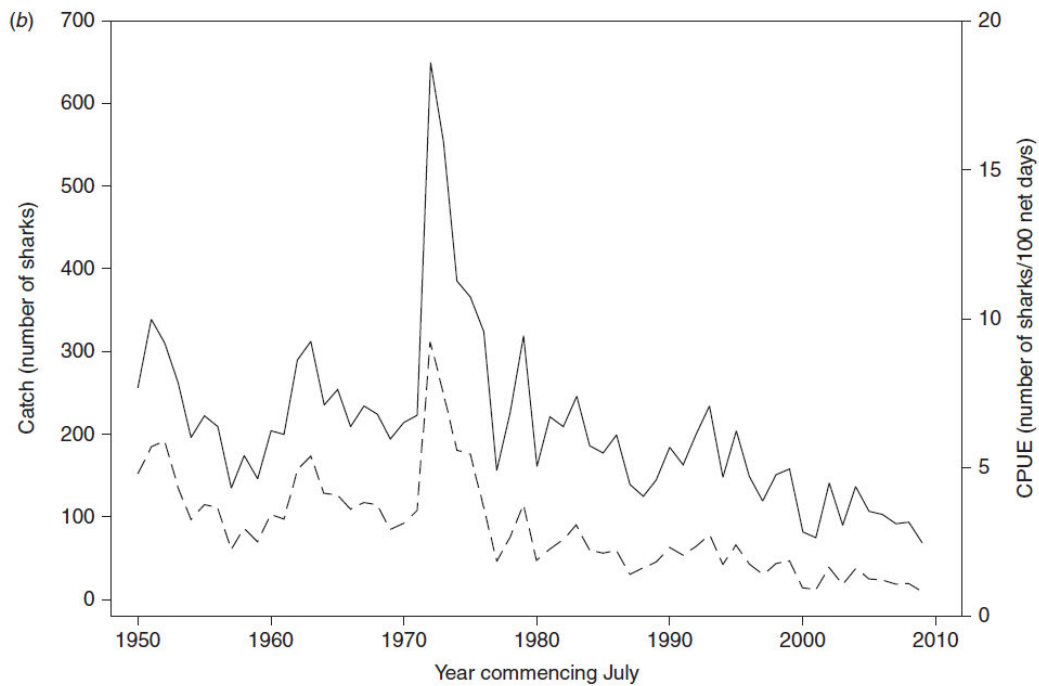


Figure 7 - reproduced from Reid et al (2011) – (a) total effort (number of net days) separated by region for a period from 1950-1951 to 2009-2010. (b) Total catches (number of sharks) by year (solid lines) and catch per effort (number of sharks per 100 net days) 1950-1951 to 2009-2010 (dashed lines).

This depletion effect is similar to many unregulated and unsustainable fisheries. A classic and relevant example from a shark fishery in Australia relates to the fisheries for school and gummy sharks where catches plummeted after an unregulated expansion of fishing, including the use of gillnets (Walker 1998).

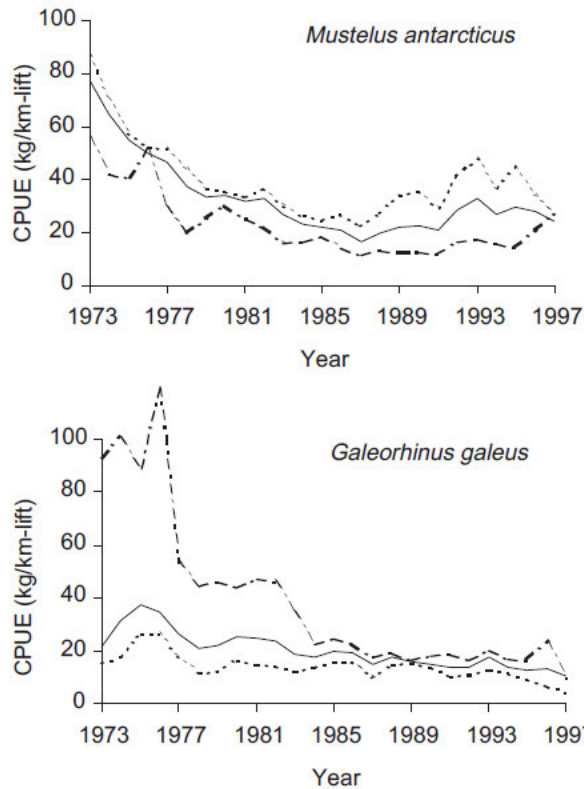


Figure 8 - reproduced from Walker (1998) – *Mustelus antarcticus* and *Galeorhinus galeus* CPUE trend during 1971-1997 for gill-nets of 6 inch mesh in Bass Strait (-----), of 7 inch mesh off South Australia (-.-.-.-) and of all mesh sizes and Bass Strait and South Australia combined (unbroken line)

The pattern displayed by the meshing program in New South Wales is much more consistent with a depletion model than a migration disruption model. The DPI needs to clarify its current narrative that the meshing program is not a cull aimed at depleting sharks to some undefined lower level.

This depletion effect appears designed to operate on a regional scale, thus the un-netted beaches are protected by the regional scale decline in shark numbers which is driven by netting at 51 beaches. As mentioned by Cliff and Dudley (1992) the low catch rates are maintained by migration of sharks into the meshing zone. Without this, catch rates would be close to zero. Krogh's (1994) observations that catch rates are higher at the northern and southern end of the NSW meshing zone would be better explained by sharks migrating into the meshing area than sharks being dissuaded by the nets in some way and migrating out from the centre.

If depletion is indeed occurring the NSW DPI needs to explain what is the lower limit of the shark population that is being pursued. If the sharks were the subject of a managed commercial fishery most fishery managers would be seriously concerned at the marked drop in catch rates, especially when the catch involves animals which are well known for their susceptibility to fishing pressure.

The meshing program removes animals before they reach reproductive age. Great White Sharks become sexually mature at 3.0-3.6m in length (depending on sex)(Bruce and Bradford 2008) . According to Reid et al (2011) there has been a decline in average shark size caught in the mesh nets and most animals taken are juveniles (<2.0m long). Unlike a managed fishery, which generally seeks to allow fish to reproduce before becoming available to the fishery, the culling programs are removing sharks before they can reproduce and thus pose a greater risk.

1.2 Cumulative impacts are not explicitly considered.

The number of White Sharks along the East Coast is not known but has been estimated at between 800 and 1200 animals (<http://www.themercury.com.au/news/tasmania/secrets-of-the-great-white-start-to-surface-with-up-to-1200-patrolling-australias-eastern-coast/news-story/7a9cbe206728fe1c63de33994cf98052>) and, at the time of listing, was believed to have been heavily depleted by a mixture of fishing and two of the bather protection programs. Measures to foster a recovery have been limited to reducing any take by fishers and most measures are focused on information gathering.

The recent culling program was not subject to any formal assessment of the potential for additional mortality of Great White Sharks to have, in combination with existing mortalities a negative impact on the East Coast population. There would appear to be no population model available to test any potential impacts and this is a serious gap in seeking to ensure recovery or prevent decline.

1.3 The Recovery Plan for the Great White Shark

As mentioned above the provisions in the recovery plan are dominated by measures aimed at collecting more information. Whilst collecting information is important it is also important to have some more rigorous controls put in place especially when there are culls aimed at reducing the number of animals operating at the same time as a recovery plan is being implemented.

There are no quantitative, time-bound targets for the recovery process. This contrasts with the tight requirements set for commercially managed species, For example, the recently released recovery plan for the redfish (*Centroberyx affinis*) has the following objectives:

- *to rebuild redfish in the area of the SESSF to the default limit reference point of 20 per cent of unfished biomass (BLIM) within a biologically reasonable timeframe, being approximately 27 years (one mean generation time plus 10 years)*
- *having reached BLIM, rebuild redfish to the maximum sustainable yield level of 40 per cent of unfished biomass (BMSY).*

The plan is a requirement of the Harvest Strategy Policy (AFMA 2009) and has explicit targets and time based milestones. The first target is to build the biomass above the limit reference point – the point at which targeted fishing is to cease. The second step is to build the stock to a level that will support a viable fishery. The effectiveness of the management actions taken can be measured against the objectives. Whilst not arguing for a fishery for the White Shark, the redfish recovery plan illustrates a level of planning and accountability that is not found in the White Shark recovery plan.

Another serious weakness of the recovery plan is the lack of any reference points, especially a limit reference point. Reference points are widely used in well managed fisheries to establish measures of the status of a fish population which define agreed management actions. Reference points are part of a suite of tools which help implement the Precautionary Principle with respect to fisheries and this Principle is a key component of international agreements such as the Law of the Sea and the UN Fish Stocks Agreement.

For a commercially exploited species there may be a target reference point established which defines the population level at which the stock should be maintained to maximise sustainable yield. There will also be a limit reference point which defines the lowest a stock can decline before fishing is to cease. In the case of gummy sharks (*Mustelus antarcticus*), managed under the Fisheries Management Act 1991, the target reference point is 48% of the original biomass and the limit reference point is 20% (See AFMA 2009).

The EPBC Act makes use of reference points in the case of Cascade Plateau stock of orange roughy (*Hoplostethus atlanticus*) which was listed as 'Conservation Dependent' and the subject of a Conservation Plan administered by the department of the environment. The target reference point set was at 60% of the original biomass and the Allowable Catch is set in order to ensure that the stock is kept at or above this reference point. Whilst the administrative arrangement have changed and this species is now managed under AFMA's rebuilding plan and the target reference point set at 48%. This case illustrates how the department of the environment can have fish stock rebuilding plans that have clear reference points.

However, in the case of the White Shark there is no such protection. The lack of rigorous management oriented decision tools in the recovery plan is worrying, especially in the case of the lack of a limit reference point. If the culling programs are impacting the population of White Sharks then there is no pre-agreed trigger for management action, such as the cessation of these programs. Ironically, as a listed species the White Shark is more poorly protected than it would be if it was a commercially managed species.

As mentioned above, the culling programs are designed to deplete sharks to an unspecified low level. This level could be well below what is required for the shark population to be self-sustaining. Whilst this level of mortality may be tolerated for a certain level of removals the expansion of the programs raises the issue of cumulative impacts. The potential for such impacts does not appear to have been modelled and the approval mechanism for the new culling program does not appear to be based on any robust, defensible and publicly available assessment of the potential for such cumulative impacts.

Whilst there are a number of species for which there are no reference points in place (such as seals) this can be tolerated as these are only subject to accidental mortality and the risk of population decline would have to be far lower than would be the case if there was a targeted hunt. In contrast, the White Shark is a targeted species in a program specifically designed to reduce its numbers over large areas of coastline to an unspecified low level. This increases the risk of population level impacts and should require the sort of protection given to unlisted species.

2.0 The Recovery Plan and the Law of the Sea

The lack of reference points raises the question as to whether the Minister administering the EPBC Act is implementing the requirements of the UN Law of the Sea. Appendix 1 contains the explanatory memorandum for the Fisheries Legislation Amendment Bill (1999) which sets out the

rationale for a number of changes to the management of fisheries managed by the Commonwealth government. There is an explicit commitment to implementing the Law of the Sea:

The second schedule provides for the implementation of principles, rights and obligations associated with the Agreement for the Implementation of the Provisions of the United Nations Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks ('UNIA' or the 'Fish Stocks Agreement'). Australia being a party to this agreement and the agreement coming into force will assist with the long term conservation and sustainable use of stocks of fish which either straddle the AFZ-high seas boundary or being highly migratory pass through the AFZ.

This document cites a number of commitments that demonstrate Australia's implementation of the requirements of the Law of the Sea such as:

1. The Fisheries Management Act 1991 which requires the implementation of the precautionary principle,
2. The National Oceans Policy which sought to implement Australia's rights and obligations under UNCLOS, and
3. The EPBC Act which applies to fish and fisheries and has provisions that "are consistent with some of the general principles of the UN Fish Stocks Agreement including assessing the impacts of fishing and protecting biodiversity in the marine environment".

The Australian Fisheries Management Authority operationalised the precautionary principle via the development of a Harvest Strategy policy which set out the basis for both the determination of Total Allowable Catches (or Total Allowable Effort in some fisheries) and the setting of reference points. It also set out pre-agreed triggers and management responses in consultation with the industry and other stakeholders.

These provisions apply to species which are exploited and where the aim is not to deplete them to a level where reproduction is impaired. This is not the case for the culling programs where there is a deliberate intent to reduce the sharks to an unspecified level but one at which it is believed the risk to humans is effectively zero. As argued in the submission by Professor Laurensen (Deakin University) there is no relationship between lowered shark numbers and reductions in attacks on people, except of course, when the shark population is zero. The lack of a limit reference point and the increasing expansion of culls, which are unassessed for cumulative impacts, means that such an outcome is possible.

Arguably, the sorts of provisions that apply to the commercially managed species should also apply to the White Shark as there was a clear commitment by the government of the day to use the EPBC Act as part of its commitment to implementing the Law of the Sea. As to why the department of the environment chooses to have a lower level of rigour and accountability for a listed species than it applies to a commercial species such as orange roughy is unknown and needs more detailed exploration. A copy of a letter sent to the Minister for the Environment on this general subject and his reply is attached at Appendix 2

3.0 References

Australian Fisheries Management Authority (AFMA) (2009). *Harvest Strategy Framework for the Southern and Eastern Scalefish and Shark Fishery 2009 (amended February 2014)*. [Online].

Canberra: AFMA. Available from: <http://www.afma.gov.au/managing-our-fisheries/harvest-strategies/southern-and-eastern-scalefish-and-shark-fishery-harvest-strategy/>.

AFMA (2016) Redfish (*Centroberyx affinis*) Stock Rebuilding Strategy – 2016-2021. Available at: <http://www.afma.gov.au/wp-content/uploads/2016/04/DRAFT-Redfish-Rebuilding-Strategy-2016.pdf>

Anon 2006) – A Report on the Queensland Shark Safety Program, The State of Queensland, Department of Primary Industries and Fisheries, March 2006.

Bruce, B.D. and Bradford, R.W. (2008). Spatial dynamics and habitat preferences of juvenile white sharks – identifying critical habitat and options for monitoring recruitment. CSIRO Marine and Atmospheric Research, June 2008, Final report to the Department of the Environment, Water, Heritage and the Arts

Cliff, G., and Dudley, S. F. J. (1992). Protection against shark attack in South Africa, 1952 to 1990. *Australian Journal of Marine and Freshwater Research* **43**, 263–272. doi:10.1071/MF9920263

Cliff, G. and Dudley, S.F.J (2011) Reducing the environmental impact of shark-control programs: a case study from KwaZulu-Natal, South Africa. *Marine and Freshwater Research*, 2011, **62**, 700–709

Green M, Ganassin C, Reid DD (2009) Report into the NSW shark meshing (bather protection) program. NSW Department of Primary Industries. 134 p.

Krogh, M (1994). Spatial, Seasonal and Biological Analysis of Sharks Caught in the New South Wales Protective Beach Meshing Programme Aust. J. Mar. Freshwater Res., 1994, 45, 1087-106

Paxton, J and West, J. (2006). NSW Shark Attack Records: Monthly analyses from shark meshing areas (Greater Sydney, Newcastle, Central Coast, Wollongong). Scientific Shark Protection Summit. Medina Grand Harbourside Hotel, Aquarium Pier, Darling Harbour, NSW Department of Primary Industries and Sydney Aquarium.

Reid, D.D., Robbins, W.D. and Peddemors, V.M. (2011). Decadal trends in shark catches and effort from the New South Wales, Australia, Shark Meshing Program 1950 - 2010. *Marine and Freshwater Research*, 2011, **62**, 676–693.

Walker T. (1998). Can shark resources be harvested sustainably? A question revisited with a review of shark fisheries. *Mar. Freshwater Res.*, 1998, 49, 553-72

Appendix 1 Australia’s commitment to implementing the Law of the Sea.

Appendix 2 Correspondence between Mr Leadbitter and the Minister for the Environment