Environment and Communications References Committee
ANSWERS TO QUESTIONS ON NOTICE
Commonwealth Scientific and Industrial Research Organisation
Inquiry into Shark Mitigation and Deterrent Measures
20 October 2017

TOPIC: Tagged sharks incidents

REFERENCE: Hansard, 20 October 2017, Page 8

QUESTION

CHAIR: I've got ask you this question: have any of your tagged sharks been involved in interactions?
Russell Bradford: Not to our knowledge, no.
CHAIR: And have any tagged sharks been caught and killed in drum-line programs or nets?
Russell Bradford: Yes.
CHAIR: How many? You can take it on notice, if you don't—
Russell Bradford: Yes, I do not know the number, to be honest. I know of one that was caught in a shark net—I believe it was two that were caught in commercial fishing practices.

ANSWER

The details of the three recaptures of sharks tagged by CSIRO are provided below.

One tagged shark was captured in a commercial fish trawl and released alive (however, to-date has not been redetected).
One tagged shark was captured and killed in a shark control net deployed at Blacksmith's Beach, NSW.
One tagged shark was captured and killed in a shark control net deployed at Bondi, NSW.

Please note that tagged sharks have been recaptured as part of the NSW Department of Primary Industries tagging program. In addition, the Western Australian program deployed drum lines in response to a shark attack in the Albany region which caught two sharks, one of which had been acoustically tagged. For details the Committee is directed to the Department of Fisheries, Western Australia.

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TOPIC: Shark-cage research

REFERENCE: Hansard, 20 October 2017, Page 12

QUESTION

CHAIR: That's something you're working on at the moment; great. You mentioned on page 11 that one of the things you have worked on and provided advice on is shark-cage diving operations off South Australia. That resulted in, in your own words, 'several operational modifications to the industry including a reduction in effort and various changes to licence conditions'. We have heard some very troubling evidence, that's anecdotal, around the impacts that shark-cage diving may be having on shark behaviour. Has there been any scientific work done on changes to shark behaviour from an activity like cage diving, or is it just anecdotal at this stage?
Russell Bradford: We did do a project at the Neptune Islands, where shark-cage diving occurs. The Neptune Islands consist, largely, of a northern and a southern group of islands. The southern group does not get cage dived very often, so that was used as a control region. In the northern group, cage diving happens on a very regular basis. So we were able to look at differences between those two groups. They're only 12 kilometres apart, I believe. Yes, we did see some differences and we do have a scientific publication on that. SARDI continue to monitor the situation there.
CHAIR: That's the South Australia state government?
Russell Bradford: Yes. The main finding was that sharks do increase their residency in that area where shark diving is occurring. Again, we'll take it on notice about the proper numbers, but it wasn't a substantial increase in time.
CHAIR: We've heard that individual sharks can even recognise the signatures of different boats and that they'll only go to boats that they're used to being fed from during cage diving, or that they approach all boats.

ANSWER

The shark cage diving industry takes advantage of areas where shark numbers are naturally high, such as at seal/sealion colonies. These regions ensure a high success rate of encounter to satisfy the clients' needs, and do not rely on attracting sharks to an area where they would not normally occur.

(Bruce and Bradford 2011; Bruce and Bradford 2015). *Comparisons also revealed there were significant increases in sharks' periods of residency, the periods spent within areas where shark cage-diving operations occur and changes in sharks' diel pattern of habitat use. Changes were site-specific with no significant differences in shark behaviour revealed over the same period at an island group 12 km from regular shark cage-dive sites. The results suggest that cage-diving operations can lead to long-term changes in the site-specific behaviour of a highly vagile shark species which may need to be considered in the context of their conservation and in managing the impacts of the industry.*

(Bruce 2015). To date all published research on the effects of shark cage diving tourism on shark behaviour have been ecological in nature. In other words, these studies have investigated aspects related to *swimming* behaviour (such as swim speed and swimming depth), localised movements, patterns of residency, and influence on broad-scale movements. A common public misinterpretation of these studies is that changes in behaviour are assumed to indicate that sharks are being conditioned to associate vessels and humans with food or to become more aggressive. "*These aspects of shark behaviour have not been the subject of specific scientific investigation although the analysis of stimuli emanating from shark cage dive operations in South Africa concluded that such responses were unlikely.*"

1. Bruce, BD & Bradford RW. 2011. The effects of berleying on the distribution and behaviour of white sharks, *Carcharodon carcharias*, at the Neptune Islands, South Australia. Department of Environment and Natural Resources, South Australia. Final Report, pp45.

2. Bruce BD. 2015. A review of cage diving impacts on white shark behaviour and recommendations for research and the industry's management in New Zealand. Report for the Department of Conservation, New Zealand.

3. Bruce, BD & Bradford RW. 2013. The effects of shark cage-diving operations on the behaviour and movements of white sharks, *Carcharodon carcharias*, at the Neptune Islands, South Australia. *Marine Biology* 160 (4): 889-907.

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TOPIC: Shark recovery plan

REFERENCE: Hansard, 20 October 2017, Page 3

QUESTION

CHAIR: It is indeed. We'll follow that up, because certainly it's going to be a key thing for the committee to look at how we can standardise these kinds of things and get some veracity to them and some expertise in assessing the testing. Could I ask you about the shark recovery program or plan. You mentioned in your submission that you have input into the federal environment minister's process around the recovery plans for a number of different species—grey nurse all the way through to white sharks. Could you just briefly tell the committee where we're at with the great white shark recovery plan: when is it due to be renewed, and is there work underway for the recovery plan?
Russell Bradford: We're uncertain about the dates, but I believe it was 2014 that the last recovery plan was finalised. I'm not sure how long they run for, but the previous one was overdue, I believe. So maybe five years.
CHAIR: So let's say that's 2019. My understanding was that it was going to be late 2018.
Russell Bradford: Maybe the process starts, yes.
CHAIR: Okay. But are you providing any input to the minister or the environment department on this issue at the moment?
Prof. Bax: We have not been asked directly on a renewal of the shark recovery plan at the moment, but of course we're in pretty good contact with the Department of the Environment and Energy in these areas. Through the Marine Biodiversity Hub, I think advice goes up through to the minister.
CHAIR: Okay. The reason I want to get some timing on this is that CSIRO has been accused by a journalist at The Australian, Mr Fred Pawle, who we've taken evidence from in Brisbane, of running a protection racket, essentially, for great white sharks. The reason I'm asking this question is that you're providing input into a process that hasn't finished yet, so we're just trying to get some timing. We'll leave the dates. If you're not aware of what they are at this stage, we'll get you to perhaps follow that up for us.

ANSWER

It is important to clarify that the responsibility for drafting and reviewing recovery plans rests with the Australian Department of the Environment and Energy, not the CSIRO. The current recovery plan was implemented in 2014. Under the *Environmental Protection and Biodiversity Conservation Act 1999*, recovery plans must be reviewed within five years of their making, and based on Commonwealth Law, they will sunset 10 years after making. The CSIRO will provide input into any review on request from the Australian Government.

With respect to the existing recovery plan, the CSIRO is addressing Objective 1 (*Develop and apply quantitative measures to assess population trends and any recovery of the white shark in Australian waters and monitor population trends.* Priority 1) through the provision of the first estimate of

population size for both the eastern and southwestern white shark populations – an essential first step in addressing questions of population trend.

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TOPIC: Correlation between shark attacks and whales numbers

REFERENCE: Hansard, 20 October 2017, Page 5

QUESTION

CHAIR: Could I just quickly ask you to follow up the question on the research you've been asked to do on whales. I was in Japan a week or two ago talking to them about whaling, and they mentioned to me that we've got too many whales, because they've noticed the media in Australia is reporting that shark attacks are occurring because of the whale numbers. Obviously this is a myth, I suppose, but is there any scientific evidence to support that claim that either increased numbers or increased observations of sharks are occurring because of whale movements?

Prof. Bax: There is a published paper out there—and I don't remember the author's name—which shows that there is a nice correlation between the numbers of humpback whales off the west coast of Australia and the number of incidents of human-shark interactions. The difficulty is that the history of fisheries science, especially, is rife with correlations.

CHAIR: Which doesn't mean a causation.

Prof. Bax: It doesn't mean a causation—exactly. So there is a nice correlation. There are many other aspects which could be leading to the number of increased observations of human-shark interactions.

CHAIR: Did that study attempt to hold those variables constant? Perhaps you could get the committee the name of the study so we can have a look at it. I'd be interested to see if it took account of other factors.

Prof. Bax: Yes, we can certainly send you a copy of that paper.

ANSWER

Sprivulis P. 2014. Western Australia coastal shark bites: A risk assessment. Australasian Medical Journal 7(2): 137-142.

In a recent peer-reviewed publication (McAuley et al. 2017) it was found that although the distribution of white sharks along the west Australian coastline overlapped that of humpback whales, there was no evidence to support the statement that white sharks were following the humpback whale migration.

… Such asynchronous movements do not support one popular theory (Sprivulis 2014) that white sharks follow humpback whales (Megaptera novaeangliae) as they predictably migrate northwards along the WA coast during winter (June–August) and southwards in spring (August–November; Jenner et al. 2001; Kent et al. 2012). However, given the extent of the movements of tagged sharks off the WA coast, it is apparent that they co-occur along much of the M. novaeangliae migration route. …

McAuley RB; Bruce BD; Keay IS; Mountford S; Pinnell T; Whoriskey FG. 2017. Broad-scale coastal movements of white sharks off Western Australia described by passive acoustic telemetry data. Marine and Freshwater Research 68: 1518-1531.

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TOPIC: Risk assessment of human encounters and trends in shark populations

REFERENCE: Hansard, 20 October 2017, Page 6

QUESTION

CHAIR: ...In relation to the shark recovery program, what underlies this inquiry, I suppose, is the public safety element of shark encounters with ocean goers. In a shark recovery plan or program federally, have you received any direction from your minister or the federal environment minister to include in any of your research or advice to the next recovery plan a risk assessment, I suppose, of human encounters with shark population levels or changes in shark population levels?
Prof. Bax: No, I'm fairly confident we've never been asked to address that particular issue. Again, there may have been discussions with Barry Bruce which I'm not aware of. But we really have focused mostly on the estimation of population size and trend.
CHAIR: Okay, so there have been no directions at all that you're aware of to include public safety in the new white shark recovery plan.
Russell Bradford: Not that I am aware of.
CHAIR: Could you let the committee know if you do find out anything in that respect.

ANSWER

Although a risk-assessment of human-shark interaction is a very important consideration, recovery plans typically focus on a species' biology and ecology. To our knowledge there has been no request to CSIRO for a risk assessment of this nature.

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TOPIC: National shark coordination panel

REFERENCE: Hansard, 20 October 2017, Page 2-3

QUESTION:

CHAIR: Are you aware of anything underway in that regard? It sounds like a sensible suggestion. Is there anything underway that you're aware of in relation to a technical adviser group or a national approach to this issue?
Prof. Bax: As I said, there's already a lot of ongoing collaboration between the biologists. Collaboration is already very good in this space, at least among the scientists and between the different states and the government. I think a good step was made forward with Premier Baird's shark summit in New South Wales, which was three or four years ago. That kind of, if you like, set the stage for where the discussion could go. After that time, there was some discussion. A senator from Western Australia asked the CSIRO minister whether or not it would be appropriate to set up some kind of national panel. As I understand it, we made a submission back to our minister saying that it was probably a reasonable idea; it could occur. This was several years ago. There were discussions, and we haven't heard anything since then.
CHAIR: Could you tell us who the senator was who wrote to you in that regard?
Prof. Bax: I'll check this later on but I believe it was Senator Wang.

ANSWER

The Senator in question was the then Senator Wang.

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TOPIC: Why were sharks listed under the EPBC Act

REFERENCE: Hansard, 20 October 2017, Page 9

QUESTION

CHAIR: The two key questions I get asked at barbecues or elsewhere are, 'Why do we need to protect them?' and 'Why were they protected in the first place?' Perhaps you could answer the second question. Do you know much about the background of why they were federally listed under EPBC as a protected species?
Russell Bradford: We could take that on notice. I believe it had to do with the shark control program and declines in the number of sharks being caught.
CHAIR: As in a decline in commercial fisheries?
Russell Bradford: No, in the shark control programs; trends that we are seeing in the catch in those nets. I believe that's the case, but we will take it on notice to give you the appropriate information.
CHAIR: It seems very hard to find information going back to those kinds of decisions and why they were made. I'm just presuming there was some acceptance that they were important—important enough to protect for environmental reasons. But if you could find anything for the committee that would be appreciated.

ANSWER

White sharks were initially listed as vulnerable under the Commonwealth Endangered Species Act (ESA), the predecessor to the Environment Protection and Biodiversity Conservation (EPBC) Act, in 1997 after a similar listing on a world-wide basis by the International Union for Conservation of Nature (IUCN). Listing was granted by the then Federal Environment Minister after assessing a nomination by the Humane Society International (HSI). The ESA listing translated over to the EPBC Act on the latter's implementation in 1999. Data on many aspects of biology, movement patterns, population structure and population size were poorly known at the time. However the biological information that was available identified white sharks as slow growing, late maturing with a low reproductive output. These life history characteristics were known to render such species especially susceptible to population decline due to targeted captures or bycatch. Available indices at the time in the form of catch rates in east coast shark control programs, gamefishing, extent of commercial bycatch and declines in sightings frequency at known hotspots all suggested a pattern of historical impact on the population and ongoing population decline. This combination of factors resulted in the species protection.

It is important to clarify that CSIRO played no role in nominating or implementing protection for white sharks other than identifying to the then Environment Department that the species was poorly known in Australian waters. CSIRO's research on white sharks commenced with funding from the Federal Environment Department in response to the species listing and in recognition of the substantive knowledge gaps including a lack of robust information on population size.

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TOPIC: What information was used to categorise sharks as vulnerable

REFERENCE: Hansard, 20 October 2017, Page 9

QUESTION

Senator URQUHART: Can you comment—and maybe you will want to take this on notice as well—on what information was available that informed that decision to categorise a white shark as vulnerable?
Russell Bradford: Yes, we will.
Prof. Bax: Clearly, less information than we have now, but, yes, we will take that question on notice.
Senator URQUHART: Also, how reliable have the assessments been about the status of the white shark population? That sort of ties into what you're taking on notice.
Prof. Bax: I believe so. Clearly, there have been suggestions or estimates of the status of the white shark population and trends in the white shark population. Our own feeling is that those estimates are not direct estimates of the population; they have to make quite a lot of assumptions. We feel quite uncomfortable that some of those assumptions are getting at the answer which is needed, which is a clear, reliable estimate of the current status of the white shark population and trends.

ANSWER

It should be noted that although CSIRO has provided input into the assessment of the white shark listing and subsequent recovery plans, CSIRO did not initiate nor implement these documents. CSIRO has provided input on request from of the Australian Department of the Environment and Energy (and its predecessors).

From the 2013 Recovery Plan (page 11) (Australian Government 2013).

The white shark was listed as vulnerable under the EPBC Act 1999 on 16 July 1999. This listing was based on a number of factors, including evidence of a declining population; its life history characteristics (long-lived and low levels of reproduction); limited local distribution and abundance; and, at the time of listing, significant ongoing pressure from the Australian commercial fishing industry. At the time of listing the available data strongly suggested a significant decline in the size of white shark populations in Australian waters (Table 1). The decision to afford protection to white sharks was made by the requesting Australian Government department based on the available data at that time.

Table 1: Data available at time of listing on abundance and size of white shark populations in Australian waters

Year	Location	Data Used	Trend	Data Source
1950–1999	New South Wales	Annual catch per unit effort in beach protection nets	70% decline	Reid & Krogh, 1992; Malcolm et al., 2001
1950–1970	New South Wales	Average length of sharks caught in nets	Decline from 2.5–1.7m	NSW Fisheries, 1997
1962–1998	Queensland	Annual catch per unit effort in beach protection nets and drumlines	60–75% decline since 1962	Malcolm et al., 2001
1961–1999	South eastern Australia	Capture in sports fishery relative to other large sharks	95% decline	Pepperell, 1992
1980–1990	South Australia	Annual game fishing catch	94% decline	Presser & Allen, 1995

Note that the majority of evidence in Table 1 is from shark control programs that have employed shark nets and drumlines in NSW and Queensland. The evidence from South Australia is based on observed declines in abundance in sport and gamefishing activities.

The life history characteristics of the white shark (specifically: low fecundity, late maturity, and longevity of up to ~60 years) indicate that they have a low rate of productivity, estimated at 0.04 to 0.056 (Smith et al. 1998). This implies that the ability of the white shark to recover from a significant decline in abundance is low.

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Reid DD & Krogh M. 1992. Assessment of catches from protective shark meshing off New South Wales beaches between 1950 and 1990. Australian Journal of Marine and Freshwater Research 43: 283-296.

Malcom H; Bruce BD & Stevens JD. 2001. A review of the biology and status of white sharks in Australian waters. Report to Environment Australia, Marine Species Protection Program, CSIRO Marine Research. Hobart, pp 113.

NSW Fisheries. 1997. Great white shark protection in NSW, Fishnote, Rober Bell (ed), DF68:1-2.

Pepperel JG. 1992. Trends in the distribution, species composition and size of sharks caught by gamefish anglers off south-eastern Australia, 1961-90. Australian Journal of Marine and Freshwater Research 43: 213-225.

Presser J & Allen R. 1995. Management of the white shark in South Australia. SA Fisheries Management Series, paper 6, May 1995. Primary Industries, South Australian Department of Fisheries, Adelaide.
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