Harrisson's Dogfish Status Review Report: ID271

Peer Review Comments

We solicited review of the Draft Status Review Report: Harrisson's from five potential reviewers. Three people agreed to be reviewers and provided reviews. Reviewer comments are compiled below from comments on drafts of the manuscript and are not in the order of the reviewer identification list below.

Reviewers (listed alphabetically):

Mr. Ross Daley
Fisheries Biologist; PhD Candidate
Commonwealth Scientific and Industrial Research Organization (CSIRO)
Hobart, Australia

Mr. Ken Graham
Research Associate
Australian Museum
Sydney, Australia

Dr. John A. Musick
Professor Emeritus
Virginia Institute of Marine Science
Gloucester Point, VA, USA

Reviewer Responses to Terms of Reference Questions (in random order)

Status Review of the Great Hammerhead Shark
Evaluate the adequacy, appropriateness and application of data used in the Status Review document.

1. **In general, does the Status Review include and cite the best scientific and commercial information available on the species, its biology, stock structure, habitats, threats, and risks of extinction?**

Essentially yes, with the exception of two papers published in 2014 that are not yet widely circulated.

The Status Review includes and cites the best information available. I would delete the reference to population doubling time in the section on Reproduction and Growth from Fish Base, as the values are biologically impossible with a generation time of 28.5 years and a fecundity of 1-0.66 (two pups every two to three years).

Yes

2. Are the scientific conclusions factually supported, sound, and logical?

Yes

Largely. There is clear evidence of major decline through key parts of the range on the eastern Seaboard The conclusion that the species is "currently" at high risk of extinction needs clarification. Risk of extinction in the next ten years is probably low. Output controls have mainly ended targeting and incidental catches, while still a threat but effects are likely to take a few years at least. There is less evidence for extinction risk on offshore seamounts. It seems a reasonable assumption that seamounts are a separate population, based on what we know from tracking of related species. This is newly published data that could be incorporated - Daley et al 2014

The scientific conclusions are factually supported. The continental population is clearly at risk of extinction, but the seamount population is not. However because the seamount population is probably much smaller than the continental population, and as there are no accurate population estimates of the seamount population size, the parsimonious conclusion is that the entire species is threatened.

3. Where available, are opposing scientific studies or theories acknowledged and discussed?

Largely, there really aren't any substantiated opposing theories, but the uncertainties could be better stated

This is a very thorough and cogent Status Review, which has included all of scientific information I am aware of (I am conversant with the literature on the species).

NA

4. Are the results and conclusions of the Extinction Risk Analysis supported by the information presented?

Largely, but see the notes on the uncertainty

The results and conclusions of the Extinction Risk Analysis are supported by the information presented. However see my comments in paragraph two above.

5. Are uncertainties assessed and clearly stated?

This is not entirely comprehensive. Stock structure is a key uncertainty. If the seaboard habitat is highly fragmented there may be more than one stock there. Conversely if seamount populations mix with the eastern seaboard then the risk is lower. The risk due to the timeframe for recovery is stated accurately but could be more precise – See Irvine et al. We could predict 80+ years. In that time sea surface temperature will rise and it is likely that anthropogenic events like oil spills, even very localized, could have an effect. Female

reproductive cycle is unclear. Individual movements in/out of the closure are a key uncertainty.

Uncertainties have been assessed and clearly stated.

Yes

Summary of evaluation by one reviewer:

This review by Ms. Margaret Miller summarizes and assesses all available information on Harrisson's Dogfish.

This species is endemic to deep-waters off eastern Australia, principally on the upper and mid slope (300-1000 m depth) along the continental margin, but also including seamounts and oceanic ridges in the Tasman Sea and to the north of New Zealand. Its core range is recognized as eastern Australia and, because of strong evidence of a sharp decline in population numbers, the species was nominated in 2008 for listing as a 'Threatened Species' under Australia's EPBC Act. Since then, much work has been done by local researchers and fishery managers to assess the current status of Harrisson's Dogfish in Australian waters. All historical catch and research data were re-examined and analyzed, and new population surveys and fishery studies completed, resulting in several 'Scientific Working Group' discussion papers, reports and journal papers being published on the species. However, there are still some aspects of the species' biology (age and growth, gestation time) and population structure (extent of connectivity between widely separated sub-populations) that remain to be more precisely determined.

In 2013, all the new information was evaluated by the Threatened Species Scientific Committee who found that Harrisson's Dogfish was eligible for listing as 'Endangered' (highest listing) but ultimately recommended a listing in the lower 'Conservation Dependent' category "subject to actions specified in the plans of management being implemented under law".

In this 'Harrisson's Dogfish Status Review', Ms. Miller has fully canvassed the available literature and comprehensively summarized the current knowledge of the species. She describes and assesses the demographic and biological data, the impact and extent of past and current fishery activities on the species, and the management and conservation practices that have been implemented or proposed by Australian fishery management authorities to arrest the known decline of the Harrisson's Dogfish population. She also discusses some uncertainties within the data such as the implications of its fragmented distribution pattern that may lead to genetic isolation of sub-populations.

There is no dispute that the coastal population of Harrisson's Dogfish has been greatly depleted by commercial fishing activities, particularly along the south-east coast of Australia following the development of deep-water trawling in the 1970s, and continuing fishing pressure over a significant portion of its core distribution is inhibiting population recovery. The author concludes that Harrisson's Dogfish is currently at a "high risk of extinction" and cites several factors to support such a status e.g. population fragmentation, low abundance, very low fecundity, and continuing fishing mortality. While "high risk" may be considered an over-

statement (there are no criteria given to define 'high'; a significant portion of its core range is only lightly impacted by commercial fishing activity), there is no doubt that the available information does justify the assessment of the species as being at some degree of risk of extinction.

While the recently introduced management measures (e.g. protected areas, no-take provisions) are important, their effectiveness will take many years to assess and may well be nullified by continuing incidental fishing pressure. Ms Miller discusses these (and other) uncertainties, and introduces the possibility of unforeseen environmental or anthropogenic events causing irreparable damage to a now vulnerable species. But ultimately, it is the combination of the species' overexploitation, fragmented distribution, and life-history traits that gives validity to the author's conclusion that Harrisson's Dogfish is in danger of extinction.

I am confident that the text accurately describes the historical fishery surveys and research, and the complex management arrangements in Australia that pertain to Harrisson's Dogfish.

Editorial Comments

Throughout document, reviewers made minor editorial changes (to sentence structure, word choice, etc.) and also included additional (or revised) citations for some of the information presented in the document.

The substantial reviewer edits/comments are shown in italics below.

Page iii – *Historical data was generally reported accurately to family but not to species.*

Page iv – *It is unknown whether the measures are currently adequate in addressing threats to the species now or during the timeframe needed for recovery, which is likely to exceed 80 years (Irvine et al. 2012, Daley et al. 2014).*

The 21% estimate of depletion is *approximate* as there is high uncertainty with this estimate.

The severe decline in the population of Harrisson's dogfish has occurred *on Australia's eastern seaboard and not necessarily on the remote seamounts in the Tasman Sea. What does "currently at high risk of extinction" mean? Within 20 years? And it may not be at a high risk of extinction throughout its range if the seamount population is different from the continental margin population.*

Page 6 - "*Last and Stevens (2009)* recognized *seven* species of *Centrophorus* from Australian waters: *C. harrissoni, C. moluccensis, C. zeehaani* (previously referred to as *C. uyato* Australian subpopulation; White et al. 2008), *C. niaukang, C. squamosus, C. westraliensis* (previously considered to be conspecific with *C. harrissoni*; White et al. 2008), and *C. granulosus*; *with White et al. (2013) synonymizing C. naiukang with C. granulosus, this number has been reduced to six (see also Bray 2014).*"

Page 7 - Harrisson's dogfish is distinguished from other *Centrophorus* species . . ." *I think this whole paragraph is problematical. You cannot "distinguish (it) from other Centrophorus species" unless all species are discussed. Most of the 'characteristics' presented are common to all Centrophorus spp. The attributes gleaned from the DPI ID Guide are only useful in the context of the 3-4 species found off the NSW coast and should not be used as a diagnosis of the species. This para may be better with a brief description of Harrisson's Dogfish (as in Last & Stevens or Ebert et al.) giving max. sizes of males and females. A taxonomic description and key is beyond the scope of this document, and unnecessary.*

Page 9 – "which can live to be over 46 years (Wilson et al. 2009)" *This reference in Wilson is to a paper by Fenton who used a radiometric method that was subsequently found to be flawed by Cotton. Estimated time for recovery based on closely related members of the Centrophoridae is 80 years (Irvine et. al 2012).*

I checked with Diane Bray - she recently updated the website with White's 2013 revision (published Dec. 2013) but the webmaster hasn't yet updated the citation to 2014.

Graham and Daley (2011) is the definitive paper on Australian gulper/Harrisson's biology; all other references quote data collected by Graham (most) and Daley. There are no other original reproductive data available.

A preliminary ageing study of C. harrissoni by Whitely (2007) (thesis cited in TSSC 2013) found that females matured between 23 and 36 years of age, and males between 15 and 34 years. This ageing study by Whitely was done independently of Graham's long-term data collection, and should be cited separately.

*"*Breeding sites for Harrisson's dogfish are thought to include waters off eastern Australia, from Port Stephens to 31 Canyon, areas off North Flinders and Cape Barren in southeastern Australia, and waters around Taupo Seamount (Williams et al. 2012)." *These sites are based on the recent (2009) longline survey; historically, Kapala data show mature males and females on the 3 grounds surveyed in 1976-77 (see Andrew et al. 1997).*

Page 10 – *It seems likely that there are* two separate stocks.

Electronic tracking of Centrophorus zeehaani, a closely related species indicates individuals move between the 300 and 600 m bathymetric contours near the seafloor on a diurnal basis (Daley et al. 2014).

It seems almost certain that the deep water between the Australian eastern continental margin and the seamount chain are a habitat barrier between these two stocks, separating the species into two possibly distinct populations (SWG 2012). *Tagging studies to date are limited with and recaptures are insufficient to determine if* that the seamount and continental margin populations do not, in fact, mix.

"The other stock occurs on the Tasmantid Seamount Chain off NSW and southern Queensland, including the Fraser, Recorder, Queensland, Britannia, Derwent, Barcoo and Taupo Seamounts (referred to as the "seamount stock") (see Figure 3)." *Despite Gascoyne being included in Williams et al's map, there are no substantiated records of Harrisson's Dogfish from the Gascoyne Seamount.*

"However, no genetic studies have been conducted to confirm that these two populations are genetically distinct, nor are there any tagging studies to confirm that the seamount and continental margin populations do not, in fact, mix." *48 Harrisson's were tagged on the seamounts (Williams et al. 2013b; 83 Harrisson's were also tagged on the 2009 gulper survey. I don't think there have been any tag returns of to date).*

You have reported this correctly but I see some problems with the arguments. First, the distances between some seamounts is greater than the distance from the continental slope to some seamounts. Also, the sex ratio biases on seamount catches may have been an artefact of sampling: almost all Harrisson's were caught as bycatch of commercial targeting of blue-eye trevalla (large teleost) and not randomly around the seamounts. We also assume that 1:1 sex ratios are normal but, with such a long reproductive cycle, one male may suffice a number of females (it's common in mammals!).

Page 11 – "This is in contrast to the population found in Australian waters which appear to prefer shallower depths of ~ 220 – 680 m (Daley et al. 2002; Last and Stevens 2009)." *Daley et al (2002) report actually says "greatest abundance between 400 and 800 m" for Harrisson's Dogfish.*

Page 13 – Various edits to the description of the fisheries: *The GHaT doesn't "operate from the coastline . . ". The NSW and southern Qld coastal areas out to 80 n miles are under State jurisdiction and no autolining is permitted i.e. through much of the Harrisson Dog habitat (see Fig 3c). Auto-liners can operate to the east of this line, including some seamounts (Taupo and Barcoo). And on upper slope areas south from the NSW/Victoria border down to and around Tasmania and further west (Fig 3c).In summary, they may impact on Harrisson's on two seamounts and in the areas to the east of Bass Strait and off eastern Tasmania.*

To clarify: this sector (CTS) includes otter trawling (known as 'dragging' in the USA) and Danish seining. Trawling occurs all around SE Australia (as shown in Fig 4), with much effort on the upper slope between Sydney and eastern Tasmania i.e. on much of the core Harrisson's habitat. Danish seining is restricted to shallow coastal waters off Victoria (primarily in Bass Strait) and never on the slope i.e. no impact on Harrisson's. There may be very occasional mid-water trawling for alfonsino in Australia's 'remote zones', but no pair trawling anywhere.

Page 14- "In NSW commercial fisheries, Harrisson's dogfish may be caught by the Ocean Trap and Line Fishery and the Ocean Trawl Fishery." *Yes. In reality, NSW trawlers very occasionally fish the upper slope off central NSW but most of the upper slope (Harrisson's habitat) is not*

trawlable between Barrenjoey and the Qld border. There is very low-level line fishing on the slope off northern NSW

Page 15 - *Log books were only introduced around 1990, long after gulpers had been almost totally extirpated from the trawl grounds.*

"However, by the late 1980s, substantial numbers were being sold in NSW following the development of the shark liver oil market.' *I don't think this is true. As catch rates of the more marketable teleosts declined during the 1980s, more deepwater sharks were marketed but, by then, catch rates were quite low and there was little or no targeting of dogfishes off NSW.*

The shark liver oil market developed off Victoria and Tasmania and targeting occurred there. With the creation of a liver market in the early 1990s, one or two vessels targeted gulper sharks with gill-nets off eastern Bass Strait, mainly for their livers. Little, if any, of this would be sold through Sydney. Here, 'dogfish catches' include all Squaliform sharks, not just Centrophorus.

Page 17 - These decreases in survey catch rates *provide compelling evidence* of declines of over 99.7% in relative abundance of *C. harrissoni* on the upper-slope of NSW after 20 years of trawling activity (Graham et al. 2001). *This area represents a key part of the core range of the eastern seaboard population.*

*"*Catch rates of Harrisson's dogfish in the SESSF has been minimal in recent years , with the species now taken only as incidental bycatch" *Trawling continues but there are few captures because there are very few left to catch. There has been a reduction in fishing effort over the last decade because of reduced teleost catch rates (more than half the fleet has left the fishery)but there is still substantial trawling effort on the NSW slope grounds which mops up any remaining gulpers!*

Page 18 – "The distribution of recent (2006-2010) commercial fishing effort . . ." *This para reads well. But I have a problem with Fig 7: there is no auto-longlining allowed off NSW but (a) shows quite a lot of activity off NSW. (I will check with CSIRO as to where these data came from.) Figs 9 and 10 also give fishing effort around SE Australia – maybe you don't need both Fig 7 and Figs 9 & 10.*

Page 20 - *Overall these data indicate post capture mortality of* Harrisson's dogfish following this type of fishing *gear is highly uncertain and likely to vary with soak time in particular. The combination of these gear types is of concern as automatic longline vessels deploy up to 15,000 hooks per vessel per day on steep and rough ground that would potentially be refuge from trawling.*

Page 24 – Regarding the PECE analysis - *A series of key uncertainties hamper this type of assessment including post capture mortality, stock structure, gestation, preferred habitat, individual home range and movement in and out of closures.*

Regarding the threat of other natural or manmade factors, given that it would take over 80 years for the species to recover, *there is a high likelihood that even a single oil spill or climate change will affect recovery.*

Page 31 – "South of Sydney, only one known area (with both mature females and mature males) of Harrisson's dogfish has been found and is located in the Flinders Research Zone." *Yes and this is a key point.*

Page 32 – "Environmental and anthropogenic perturbations or catastrophic events may also lead to local extirpations " *Yes, this is likely*.

"Given the spatial structuring of the species, with males dominating the majority of sites and only a few sites containing mature females," *Yes and see Daley 2014 – Mature females of related species are likely to stay put.*

"Therefore, activities that target or incidentally catch Harrisson's dogfish would automatically result in overutilization of the species and present a threat to the species existence." *Separate these arguments. Targeting will automatically be a threat to species existence. Incidental catch has the potential to, but is uncertain.*

Page 33 – "At this time, it is *highly* uncertain whether currently regulatory measures are adequate in reducing these threats to the species as these measures have only recently been implemented and have not yet had time to show effectiveness." *There are many uncertainties including post capture mortality, the female breeding cycle, stock structure, movement of individuals in and out of closures.*

"Due to the aforementioned threats, we conclude that the Harrisson's Dogfish is currently at a high risk of extinction throughout all of its range" *at least on the eastern Seaboard, but possibly not on the remote seamounts in the Tasman Sea.*

Page 35 - *I don't think 'sites with predominantly mature males' has previously been mentioned. P. 9 talks about breeding sites (i.e. with mature males and fems), and sex ratios on seamounts (mainly females) are discussed on pp.11-12.*

Page 37 - *A lot has been made of the male-dominated sites (by Williams et al. etc), but most of the sex-ratio data comes from one fleeting survey in 2009 (Diana long-line survey) with relatively low catch numbers. As discussed earlier, the sex-ratio biases may be an artefact of sampling, or they may be natural. The 1976-77 catches of Centrophorus spp. were dominated by males (see Cruise report 117; Andrew et al 1997).*

"Based on the recent observed discard rates, and evidence that even low levels of fishing effort can lead to rapid and high depletion of the species (see Figure 13), this incidental fishing mortality is considered a threat to the species that significantly increases its risk of extinction." *Does Fig. 13 really show that?*

Page 38 – *When will the regulatory mechanism be evaluated? By whom?*

What is "diversity"?

Does 'high' meet some criteria that you assess the risk by, or is it your opinion after weighing up the evidence? The reason I ask is that, having started on my Referee Report on your Status Review, I referred back to the assessment of the species by our Threatened Species Scientific Committee who worked with set criteria for the various listing categories. That makes it easier to see the reasons for their decision. The committee found that the species met the criteria for 'endangered' but opted for the lower 'conservation dependent' with caveats attached. Ditto for IUCN listing: it met the IUCN criteria of 'endangered'. I think 'high risk of extinction' is overstating the risk, particularly with low fishery interaction through a significant part of its range, including seamounts, and the no-take and other management provisions now in place. Do you have criteria for 'high risk of extinction'?