Southern and Eastern
Scalefish and Shark Fishery

Shark Resource Assessment Group (SharkRAG)

MEETING OUTCOMES

SHARKRAG Teleconference, 2013

8 MARCH 2013

Chair	Dr Colin Simpfendorfer
Date	8 March 2013
Location	Teleconference

Attendance

Members and Permanent Observers

Dr Terry Walker	Victorian Department of Primary Industries.
George Day	AFMA
Dr Colin Simpfendorfer	James Cook University
David Stone	Industry representative
Dr Robin Thomson	CSIRO Marine Research (for part of the teleconference)
James Woodhams	ABARES
Anissa Lawrence	Environment member candidate (for part of the teleconference)

Observers

Dr Malcolm Haddon	CSIRO Marine Research
Erik Raudzens	AFMA, RAG Executive Officer
David Power	AFMA
Joshua Cahill	AFMA

Apologies

Dr Rory McAuley	Western Australia State Observer
Alan Robertson	Industry Member
Dr Jeremy Prince	Biospherics Pty Ltd
Steven Brockwell	Industry member
Kyriakos Toumazos	Industry member

Agenda

The AFMA Commission, following the meeting held on 25-26 February, have asked SharkRAG to clarify its position in regard to its recommendation on the School Shark TAC for the 2013-14 season. The specific questions asked by the Commission and the SharkRAG responses are provided below:

1. Does SharkRAG support the current stock assessment model for School Shark?

SharkRAG agreed to adopt the current stock assessment model for School Shark. SharkRAG noted that while the model was 'world class' in terms of capturing the complexity of the species, the model has suffered a lack of an accurate assessment of the stock for a number of years and currently has only utilised data up to 2008. Due to School Shark being actively avoided in the fishery, absence of reliable recent catch per unit effort data was likely to be affecting the models reliability. However, SharkRAG supports the use of the most recent stock assessment noting the following caveats:

a) Current inputs of catch and catch rate are unreliable.

b) Discard information is not included (or available).

c) The current outputs effectively represent a forward projection, incorporating a reliable index of abundance up to 1997. SharkRAG will consider whether the model will be updated in 2013 using recently obtained ageing data and length data from the observer program. SharkRAG will update the AFMA Commission on the results once completed.

The RAG also noted the model lacks a thorough characterisation of uncertainty caused by recent management changes implemented since the which include large spatial closures, increased hook fishing effort, low TACs and 20 % ratio requirements. Future use of the model would need to consider the aforementioned management changes.

2. What productivity factor is formally agreed for the assessment?

The RAG noted the productivity factor (maximum sustainable yield rate, MSYR) was estimated by allowing the model to predict the figure. The previous MSYR of 3.5 % was locked into the model from 2006, for reasons unknown. Dr Walker noted that the productivity factor appeared to be low for this species and other research on MSYR for similar species had estimated factors between 7.3 and 8.45 %. Dr Thomson stated that the lack of recovery in the CPUE rates may bias the model's prediction of MSYR therefore the estimate of 4.4% may be lower than those obtained in other studies. The low MSYR value can therefore be seen as conservative.

SharkRAG agreed MSYR be determined by the stock assessment model (currently 4.4%). The RAG noted that lack of recovery in CPUE rates were likely to be constraining the productivity factor to a figure lower than those obtained for similar species

3. What are the appropriate limit and target reference points?

SharkRAG agreed that the limit and target reference points will be reviewed during the formal review of the School Shark Stock Rebuilding Strategy due in 2013. The AFMA member suggested using ½ B_{MSY} (B_{25}) as the target reference point. The estimate of B_{MSY} is derived from the stock assessment model. Dr Malcolm Haddon noted there was concern over the reliability of the estimate of B_{MSY} produced by the stock assessment model and suggested the target reference limit of B_{20} be used without additional information on the estimate of $B_{MSY.}$ B_{20} is the target in the rebuilding strategy that was produced before the 2009 stock assessment and is based on the harvest strategy proxy for MSY of B_{40} with the limit reference point of ½ $B_{MSY.}$

Scientific members supported using B_{20} as the interim rebuilding targe. This was the general consensus when developing the record of the meeting noting that rebuilding targets and timeframes would be considered during the formal review of the School Shark rebuilding strategy in 2013.

The RAG also noted the Commonwealth Harvest Strategy Policy is currently under review and will align the review recommendations with the updated School Shark Rebuilding Strategy.

4. What are the outcomes of the model?

Present stock recovery projections at different levels of catch were calculated and are included in Dr Thomson's SharkRAG paper (**Attachment A**).

5. Based on the model and the agreed parameters, what is a biologically reasonable timeframe to reach the rebuilding target?

SharkRAG noted the Commonwealth Harvest Strategy Policy (HSP) guidelines regarding timeframes to reach rebuilding targets that state:

Typically recovery times are defined as the minimum of 1) the mean generation time plus ten years, or 2) three times the mean generation time.

It was noted that this is a typical example and does not limit recovery times to one generation time plus 10 years.

SharkRAG did not support the HSP guideline of one generation plus ten years considering that this timeframe was unlikely to be achievable noting the results of previous assessments and the known life history of this species. SharkRAG noted the model provided estimates of biologically reasonable timeframes at varying levels of catch.

SharkRAG agreed that the establishment of a timeframe needs to consider economic and conservation issues as well as the unavoidable level of school shark bycatch in the fishery. Therefore establishing a rebuilding timeframe was considered to be a management decision. It was also noted that the HSP is currently under review.

One SharkRAG member noted the Rebuilding Strategy for Gulper Sharks which stated:

'Given that the level of depletion in the populations is currently unknown predicting how long it will take for them to recover to either B_{LIM} or $B_{TARG,}$ is not feasible.'

SharkRAG agreed the South East Management Advisory Committee would be provided a range of TACs and the subsequent projected rebuilding timeframes for consideration. The agreed timeframe will consider economic and conservation issues.

6. The range of catches that lead to rebuilding of the stock within the recommended rebuilding timeframe

Note the comments above and Dr Thomson's SharkRAG paper at **Attachment A**. Shark RAG agreed to provide a matrix type table of various catch levels and the timeframes school shark were predicted to take to reach biomass thresholds (limit and target reference points). A table based on the projections in Dr Thompsons SharkRAG paper is provided at **Attachment B**.

7. What is the best estimate of the level of unavoidable bycatch in the fishery? (based on a weight of evidence approach that includes reported catch and estimated discards as recommended by the school shark working group)

SharkRAG agreed data from 2011 calendar year would be used for calculating unavoidable bycatch as Independent Scientific Monitoring Program (ISMP) data for 2012 is currently incomplete. SharkRAG noted the 2011 catch from Commonwealth Catch Disposal Records (CDR) was 196 tonnes and the ISMP discard rate was 9%. Based on an estimated discard rate of 9 % and a reported catch of 196 tonnes (CDR), SharkRAG considers the best estimate of total unavoidable bycatch is 215.38 tonnes.

8. Note the robustness of the model and any concerns you have about about it

See issued raised in agenda item 1.

9. Are there other fishery indicators or associated information that supports the outcomes of CSIRO's Stock Assessment Model in terms of the incidental catch and rebuilding of the stock?

SharkRAG noted:

- a research project being conducted by a PhD student at the Institute of Marine and Arctic Studies. Sampling has been conducted at School Shark pupping areas off Tasmania since January 2012. A total of 595 juvenile School Sharks have been caught and released so far. While the project has not been finalised, the results are positive when compared to CSIRO sampling conducted over the same areas between 1991 - 97

- reports from gillnet operators that they are having to work harder to avoid School Shark

- while the Southern and Eastern Scalefish and Shark Fishery Independent Survey was not designed to determine a relative index of abundance for School Shark and currently cannot be relied upon for abundance or trend information, catches are in table 1

Table 1. Recorded catch of School Shark during the South East Scalefish and Shark Fishery Independent Survey.

Fishery Independent Survey School Shark Data		
	Winter (kg)	Summer catch (kg)
2008	209	241
2010	456.5	44
2012	2264.4	342

Projecting the school shark model into the future: Rebuilding timeframes and auto-longlining in South Australia

Robin Thomson

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November 2012

Summary

The current version of the school shark model predicts that catches of up to 250t allow recovery of the stock, but 275t will not.

Rebuilding to the limit reference point (B_{20}) cannot be achieved in a generation time plus time 10 years (32 years) given current levels of catch (176t). Rebuilding in three generation times (66 years) can be achieved with future catches of up to 225t. If the limit reference point is moved from B_{20} to half B_{MSY} (i.e. B_{25}), then rebuilding within 32 years would require catches of close to zero; future catches would need to be of the order of 200t in order to achieve rebuilding in 66 years.

Recovery times are only slightly lengthened by higher levels of auto-line fishing in South Australia (SA), however, this lowers B_{MSY} so the impact of an auto-line fishery would be felt when the school shark stock has recovered to levels where the overall catch can be increased to levels closer to B_{MSY}. If the auto-line fishery in SA is allowed to take a substantial portion of the catches in that state, the overall maximum sustainable catch for school shark will be lower than it would be if the auto-line fishery remained small relative to the gillnet fishery.

The results shown here are valid for a fishery whose seasonality and regional distribution are similar to that of the 2011 school shark fishery. Substantial (or perhaps even subtle) deviations from this pattern could alter these findings by altering the size and sex composition of the commercial school shark catch.

Background

The School Shark Recovery Plan (DEWHA, 2008) states that school shark recovery to a limit and a target reference point should occur within a biologically reasonable timeframe, and suggests that one generation time plus 10 years is such a timeframe. The Commonwealth Fisheries Harvest Strategy Policy (HSP) (DAFF 2007) also gives 3 generation times as a possible time frame to use for recovery. This policy states that the target reference point should be B_{MSY} and the limit reference point should be half B_{MSY}. If B_{MSY} is unknown, B_{40} is used as a proxy, along with B_{20} for the limit. At the time of writing of the School Shark Recovery Plan, B_{MSY} for school shark had not been calculated so B_{40} was recommended. However, B_{MSY} has since been calculated to be approximately 50% of pristine (Thomson and Punt, 2009), giving B_{50} as a target and B_{25} as a limit reference point.

The current rebuilding timeframe of one generation time plus 10 years is 32 years (Thomson and Punt, 2009). The ability of the stock to recover in this timeframe is explored here.

Management of the southern shark fishery has included restriction to fishing with smaller gillnet mesh sizes in order to protect large, more fecund, females. Figure 1 shows the impact on a pristine school shark stock of fishing heavily (taking 900t p.a. until 2011) with just one gear type. Line gear, and large mesh sizes, deplete the stock more rapidly and to lower levels than smaller mesh sizes. For this reason the planned introduction of an auto-line fishery for sharks in South Australia in response to exclusion of mesh gear from certain areas (to protect Australian sea lions and dolphins) needs to be carefully considered.

This paper explores recovery times for the school shark stock given a range of future fishing scenarios, both in terms of catch and gear composition.

Methods

The 2006 stock assessment update (Punt et al 2006) used an MSYR value of 3.5%, which is essentially a measure of the productivity of the stock. Unlike previous school shark stock assessments, this parameter was fixed at 3.5% instead of being estimated by the model. The reason for this may have been that the estimated value was 3.5% and that fixing the parameter at its estimated value would have greatly speeded subsequent calculations. The MSYR parameter has remained fixed at a value of 3.5% in all subsequent calculations with the school shark model, possibly leading to lower perceived productivity than might otherwise have been the case. The parameter has been freed in the calculations shown in this paper, resulting in an estimated value of 4.4%.

The most recent school shark assessment update used data to 2008 (Thomson and Punt, 2009). Catches taken between 2009 and 2011 were extracted from the GENLOG database (see a summary in Table 1). Catches were entered into the model by year, gear, month and shark region. The database contained only partial information for 2012 so the catches for 2011 were used again to represent those for 2012.

The *2009 base case* model was used, except that the small SAV region which spans the South Australian – Victorian border which has traditionally been used in school shark stock assessments, but was excluded from the 2009 Base Case, was include here. The 2009 base case model dissolved that region into the two adjacent regions, but as this is not possible to do for all data sources, and has created technical problems, that change has not been made here. The MSYR parameter was freely estimated. This model:

- uses ISMP data for West only (not WSA, not East) (see Thomson and Punt 2009 for explanation)
- uses commercial gillnet CPUE to 1996
- uses commercial gillnet CPUE for WBAS
- uses survey CPUE data
- uses recent CPUE series (1998-2008) separate to the CPUE up to 1996

Future auto longline fishery for South Australia

We assume that future catches are split among months, regions and gears in the same proportions seen in recent catches – with one exception: that a proportion of the catch currently taken by the gillnet fishery *in South Australia* (shark regions 1 WSA, 2 CSA and 3 SAV) is taken by a new auto-line fishery. This fishery has a knife-edged size at first selectivity of 536mm (the smallest school shark caught in a recent auto-line survey, Figure 2). In the past a size threshold of approximately 630mm for males and 640mm for females (calculated from an age-based threshold of 2 years) has been assumed for a combined line and trawl fishery/fleet.

We consider a recovery scenario in which all future catches are 150t, or 200t or 250t p.a., for a range of future gear configurations. Alternatively, to mimic the harvest strategy, we fixed catches at 200t or 250t p.a. for 50 years and after that allowed catches to increase by 2t p.a.

Results

Rebuilding times for status quo fishing

Catches of up to 250t allow recovery of the school shark stock, but 275t is not sustainable (Figure 3, Table 2a).

Rebuilding to the limit reference point (B_{20}) cannot be achieved in a generation time plus time 10 years (32 years) given current levels of catch (150t). Rebuilding in three generation times (66 years) can be achieved with future catches of up to 225t. If the limit reference point is moved from B_{20} to half B_{MSY} (i.e. B_{25}), then rebuilding within 32 years would require catches of close to zero; future catches would need to be of the order of 200t in order to achieve rebuilding in 66 years.

Split of future catches

Note that the future projections used here assume that the split of the catch between months, and regions is the same as that observed during 2011. If the split observed during 2008 is maintained instead (as was done for projections previously show to the sharkRAG), somewhat more pessimistic results are obtained (Table 2). This is due to interannual differences in the seasonality and spatial distribution of catches, highlighting that the results shown here pertain only to a fishery similar to that operating in 2011. Any substantial shifts in the timing or location of the bulk of the catches would require another investigation into the sustainability, and rebuilding timeframe of the new catch regime.

Future auto longline fishery for South Australia

For interest sake, we present the model prediction of the status of the future school shark population if the whole fishery moved to auto-line gear, as compared with using only 6 inch or 6.5 inch mesh gillnets in future.

As the size of any future auto-line fishery is unknown, we consider 3 possible futures ranging from no future auto-line fishery (0%) to 100% auto-line fishing (in South Australia alone).

Compared with 6 inch gillnets, auto-line fishing takes both younger fish and the larger, more fecund females (Figure 2). It therefore impacts the stock more heavily than does fishing with 6 or 6.5 inch gillnets (Figure 1).

However, if catches remain at the present level (150t p.a.) the impact on the stock of an auto-line fishery in South Australia is forecast to be negligible (Figure 4, Table 3). However, more realistic scenarios in which larger catches are taken, particularly in the future, reveal that a large line fishery in South Australia would reduce the overall sustainable catch for the stock (Figure 5). This is because B_{MSY} is lower for a line only fishery than for a 6.5 inch mesh, only, fishery.

Recovery times are only slightly lengthened by higher levels of auto-line fishing in South Australia (SA) (Table 3), however, this lowers B_{MSY} so the impact of an auto-line fishery would be felt when the school shark stock has recovered to levels where the overall catch can be increased to levels closer to B_{MSY}. If the auto-line fishery in SA is allowed to take a substantial portion of the catches in that state, the overall maximum sustainable catch for the school shark fishery will be lower than it would be if the auto-line fishery remained small relative to the gillnet fishery.

References

DAFF (Department of Agriculture, Fisheries and Forestry) (2007). Commonwealth Fisheries Harvest Strategy Policy and Guidelines. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

Punt, A. E., Pribac, P., Walker, T.I. and Gason, A.S. 2006. Stock Assessment of School Shark Based on Data Up To 2005. Presented to SharkRAG in August 2006.

Thomson, R.B. and Punt, A.E. 2009. Stock assessment update for school shark *Galeorhinus galeus* based on data to 2008, re-analysis for SharkRAG. SharkRAG/2009/0xx.

Figures

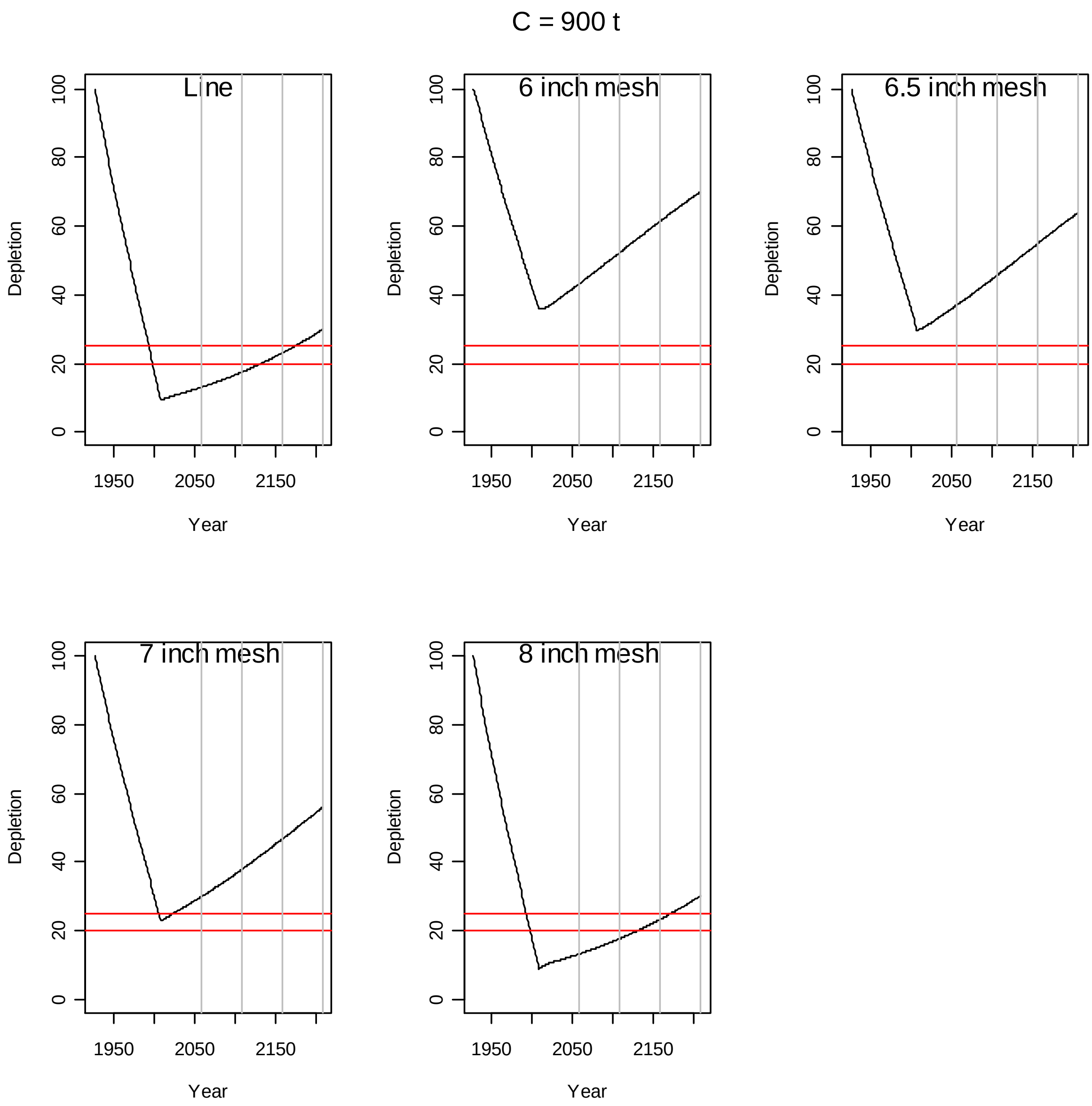


Figure 1. Using a greatly simplified version of the school shark Tier 1 model, catches of 900t p.a. were taken every year from 1927 to 2011 after which all fishing stopped. All of the catch was taking using a single gear type.

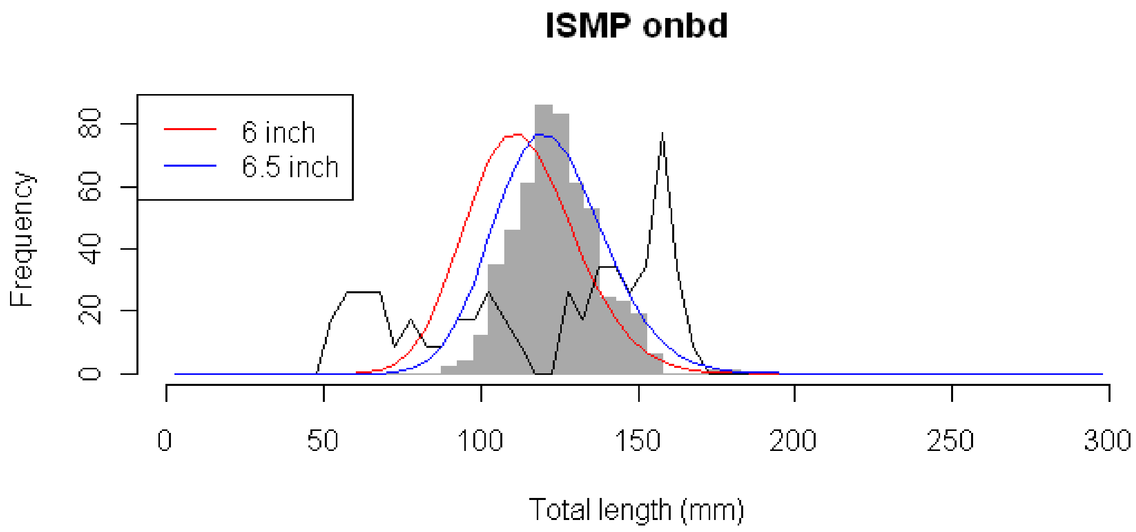


Figure 2. Length frequencies (grey bars) for commercially (gillnet) caught school shark in South Australia during summer, measured onboard by the ISMP Observer Program. The length frequency for the school shark caught during the summer auto-line survey in South Australia is shown (black line). The gear selectivity for 6 inch (red) and 6.5 inch (blue) mesh gillnets are shown.

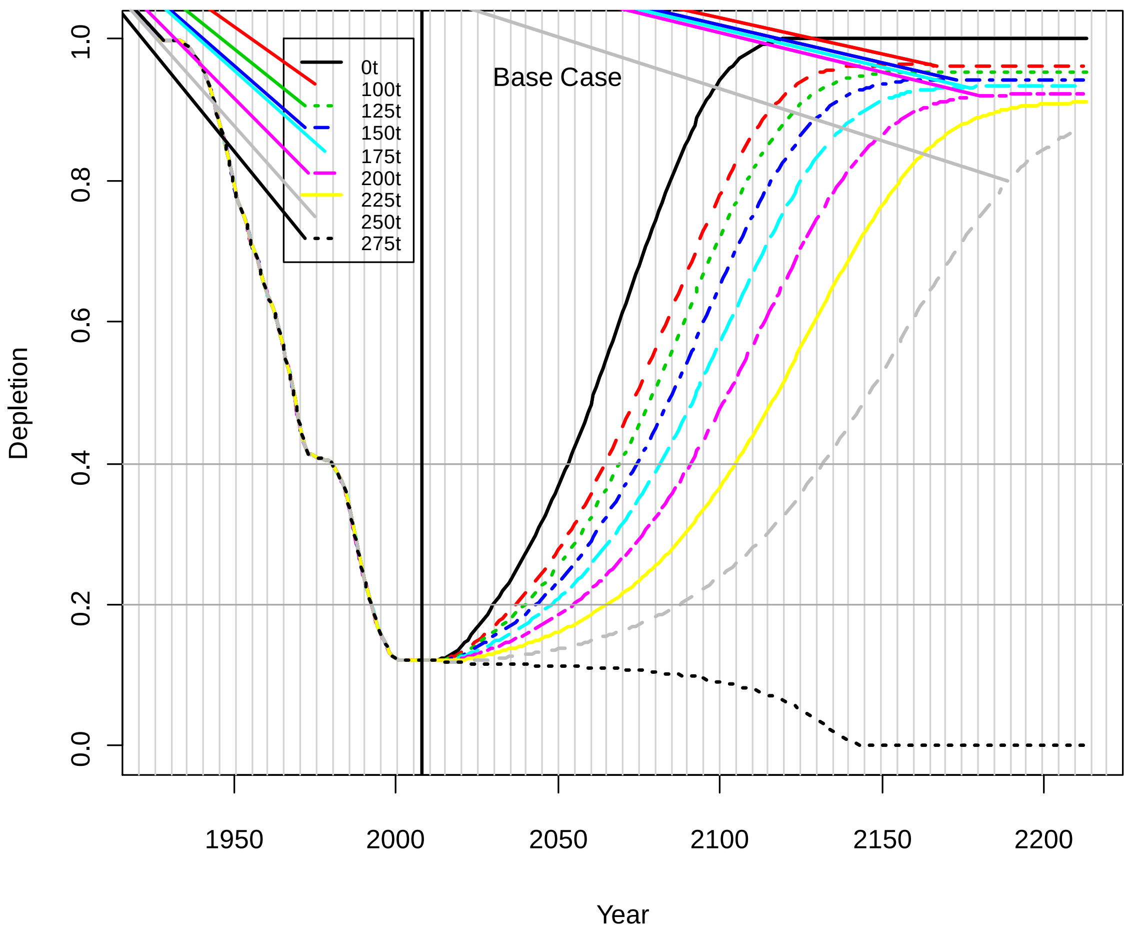


Figure 3. Projected future depletion (pup production divided by pristine pup production) for the school shark stock for the Tier 1 2009 base case assessment model. Projections are shown for 9 future catch scenarios. Catches between 2008 (marked by a vertical line) and 2011 are the actual catches taken by the fishery.

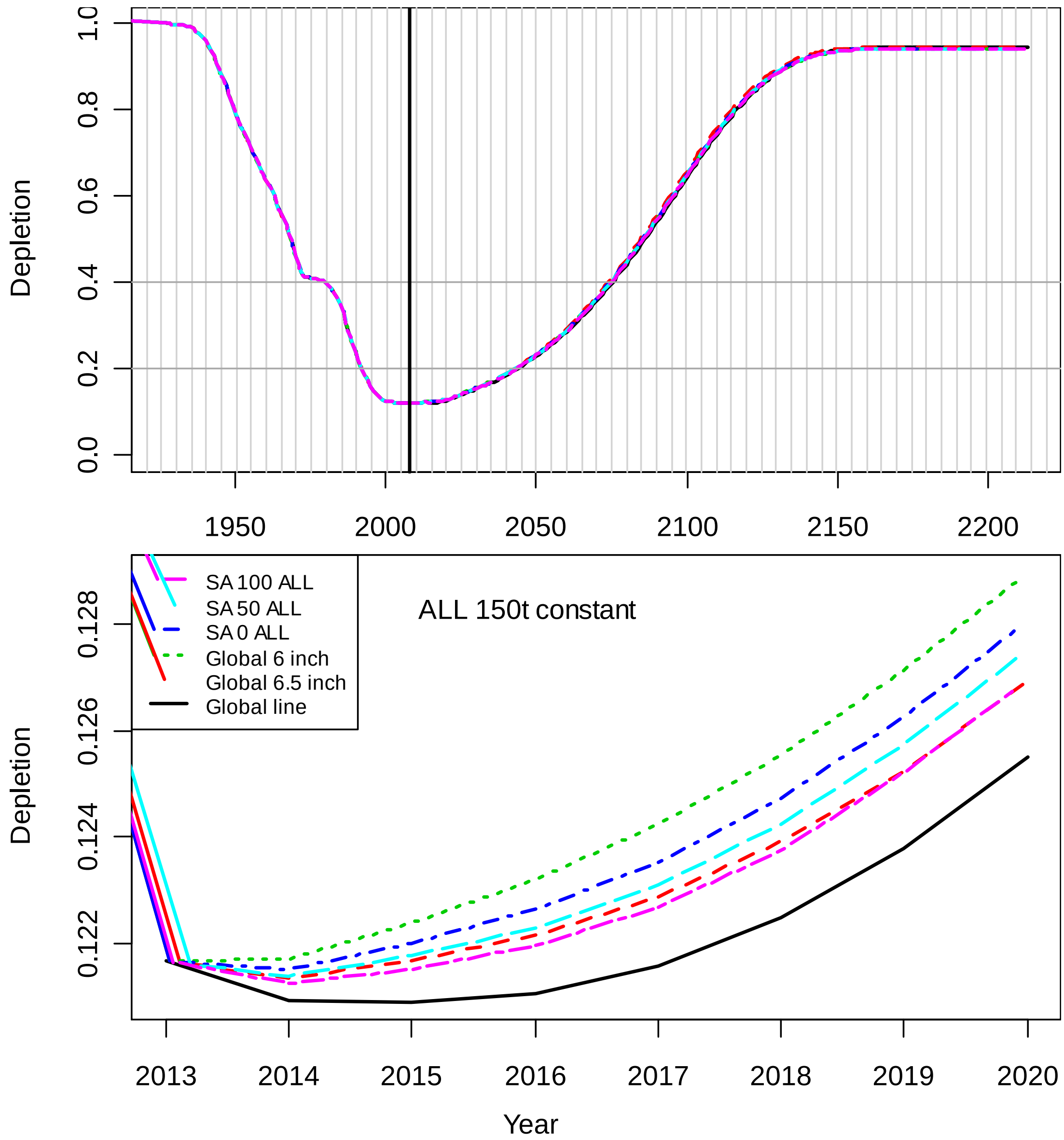


Figure 4. Projected future depletion (pup production divided by pristine pup production) for the school shark stock for the Tier 1 2009 base case assessment model. Projections are shown for various future catch combinations. The lower plot shows results for just the years 2013 to 2020, in more detail.

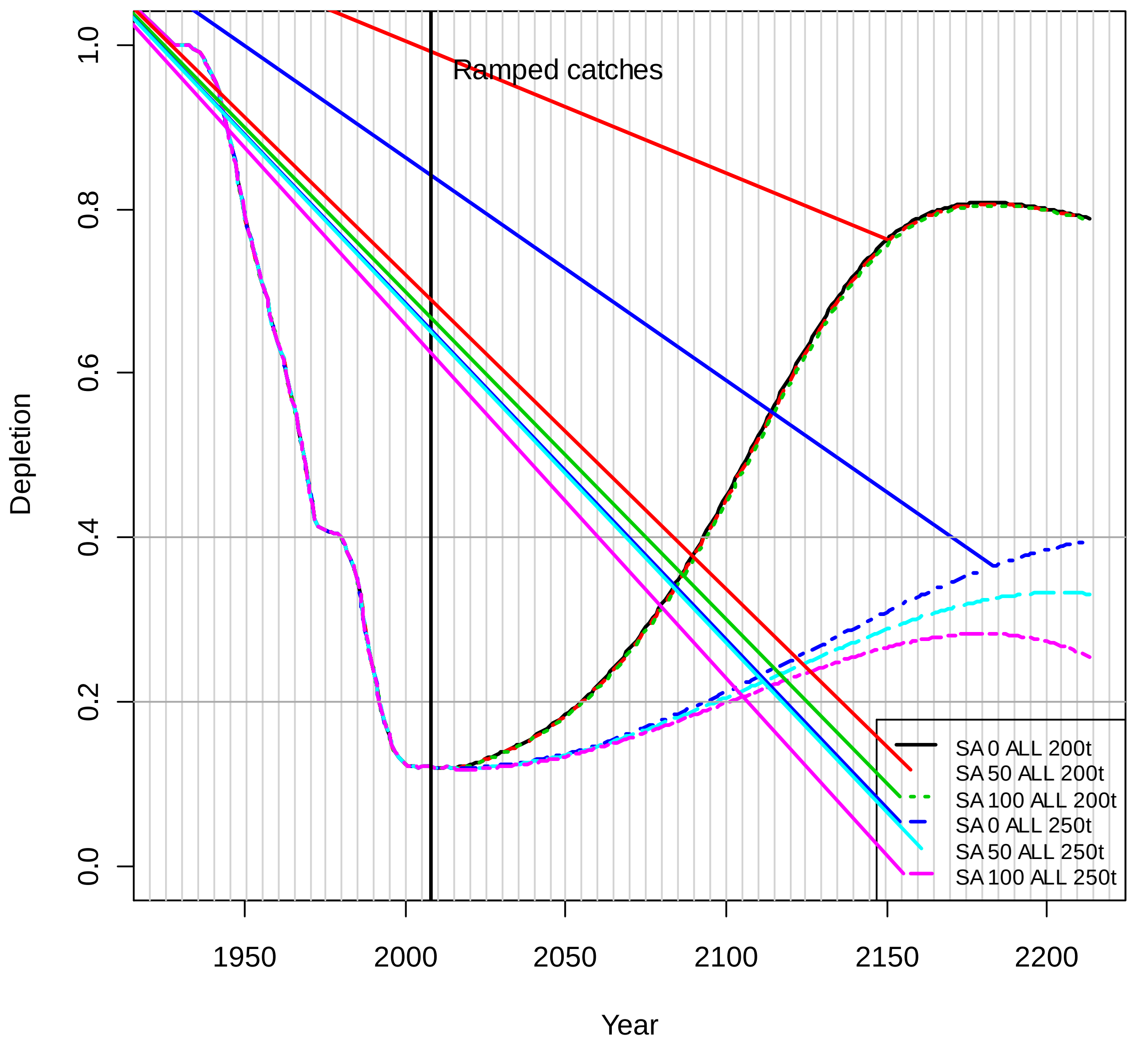


Figure 5. Projected future depletion (pup production divided by pristine pup production) for the school shark stock for the Tier 1 2009 base case assessment model. Projections are shown for future catch scenarios in which 200t p.a. (*ALL 200t*) or 250t (*ALL 250t*) are taken for 50 years from 2013 after which catches are increased by 2t p.a. results are shown for scenarios in which an auto-line fleet in South Australia takes 0%, 50% or 100% of the catches previously taken by gillnet in that state.

Tables

Table 1. Catches of school shark between 2009 and 2011 by gear (taken from GENLOG database). Catches for 2012 are assumed to be the same as those for 2011.

Year	Line and Trawl	6 inch	6.5 inch	Total
2009	19.1	140.6	85.6	245.4
2010	23.0	108.2	38.8	169.9
2011	7.8*	113.8	32.7	154.3

* this figure appears to be missing the trawl component of the catch, but this does not noticeably affect the conclusions of this paper.

Table 2. Number of years after 2008 when the school shark stock is predicted to achieve limit (B_{20}, B_{25}) or target reference points (B_{40}, B_{50}) under future catches ranging between 0 and 275t. Future projections assume either that catches are distributed according to 2011 proportions, or 2008 proportions. A generation time plus 10 years is 32 years.

	0t	100t	125t	150t	175t	200t	225t	250t	275t
2009 Base Case – 2011 proportions									
B_{20}	23	30	32	36	40	47	58	80	-
B_{25}	30	38	42	46	51	59	71	95	-
B_{40}	45	57	62	67	74	83	97	124	-
B_{50}	50	62	67	73	80	89	104	132	-
2009 Base Case – 2008 proportions									
B_{20}	23	30	33	37	42	50	64	99	-
B_{25}	30	39	42	47	53	63	78	117	-
B_{40}	45	58	63	69	76	87	105	150	-
B_{50}	50	63	68	74	82	93	111	159	-

Table 3. Number of years after 2008 when the school shark stock is predicted to achieve limit (B_{20}, B_{25}) or target reference points (B_{40}, B_{50}) under different future gear combinations, taking a constant catch over all future years. Three scenarios in which a single gear is used across all regions are included for interest sake only. Three projections in which a proportion (0, 50 or 100%) of the gillnet catch in South Australia is transferred to a new auto-line fishery are shown (note that the 0% column resembles the 175t and matches the 200t or 250t columns in Table 2). A generation time plus 10 years is 32 years.

	Global line	Global 6.5inch	Global 6 inch	0% ALL	50% ALL	100% ALL
176t p.a.						
B_{20}	42	40	41	41	41	41
B_{25}	53	51	52	52	52	52
B_{40}	75	73	75	74	75	75
B_{50}	81	79	81	80	80	81
200t p.a.						
B_{20}	49	46	47	47	47	48
B_{25}	61	58	60	59	60	60
B_{40}	85	82	84	83	84	84
B_{50}	91	88	90	89	90	90
250t p.a.						
B_{20}	87	75	83	80	82	83
B_{25}	103	90	99	95	97	99
B_{40}	130	117	129	124	126	128
B_{50}	137	124	137	132	134	136

Figure 1. Projected future depletion (pup production divided by pristine pup production) for the school shark stock for the Tier 1 2009 base case assessment model. Projections are shown for 9 future catch scenarios. Catches between 2008 (marked by a vertical line) and 2011 are the actual catches taken by the fishery.

Species Summary base on 2012 Stock Assessment Report for School Shark (*Galeorhinus galeus*)

Prepared by the Shark Resource Assessment Group (SharkRAG)

Stock Structure

School Shark is distributed around southern Australia mainly on the continental shelf and upper slope where they have been recorded from Moreton Bay (southern Queensland) to Perth (Western Australia), including Tasmania. They have been taken from the near shore zone to 550 m depth, mainly near the bottom, but at times occur in the pelagic zone and well offshore. Genetic studies suggest there are six genetically isolated populations of school shark around the world. Tag studies provide evidence of some mixing between southern Australia and New Zealand, but genetic studies suggest these populations are not inter-breeding. The behaviour of SharkRAG's assessment models supports the existence of some regional stock structure. SharkRAG's agreed assessment model assumes two stocks because insufficient data exist to support more complex stock structures.

Biological indicators

Biological productivity: Low

Trophic level: 4 (Scale: planktivorous whale shark 1, top predator white shark 5)

Associated species: School shark is taken as an incidental bycatch when targeting Gummy Shark with gillnets, and of trawling and longline fishing.

Percentage of gillnet catch targeted: Low

Percentage of otter trawl catch targeted: Negligible

Suggested environmental drivers: Not examined. Moon phase & water temp affect catch rates.

Recent catch history

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Agreed TAC (Global) (t)	274	228	352	240	240	216	176	150
Calculated RBC (t)			0	0	0	0	0	0
Actual C'wealth TAC (t)	243	228	360	263	255	233	176	150
Actual State TAC (t)	na	29	28					
GHATF catch (t)	199	209	196	234	239	178	177	128
Trawl catch (SETF & GABTF) (t)	10	27	12	13	19	19	19	13
Estimated total discard rate (IMSP)	na	na	na	na	na	na	9%	na
Estimated trawl discards (t)	1	2						
% trawl discards	17	4						
State catch (t)	15	na	?					
Total catch (t)#	211	238	208+	247+	258+	197	215	

* 2012 figures still incomplete

\# Note total catch includes catch from all sources recorded in CDRs

The above catches are those reported on catch disposal records and are from calendar year periods. TACs are reported based on fishing year, commencing 1 May. Additional catch was taken off Western Australia outside the SESSF; these were 11, 18, 17, 15, 4, 9 and 13 t during 2002-2008, respectively. Until 2011, GHATF discard rates were not monitored. However in 2011, the Integrated Scientific Monitoring Program suggested a discard rate of 9%. As the stock increases these are also likely to increase.

In contrast to Gummy Shark (*Mustelus antarcticus*), if fisheries management were to permit, School Sharks can be targeted throughout their life-cycle with hooks and gillnets. From the mid-1920s to the early 1970s, School Shark was targeted by demersal longline in southern Australia, and Gummy Shark was taken mostly as byproduct. Catches from the SESSF are thought to have peaked around 2500 t per annum during the 1960s before declining and then rising to another peak of around 2000 t per annum in the late 1980s. Monofilament gillnets, which are more effective than the shark longlines at catching gummy sharks, were introduced first in 1964, but it was not until the early 1970s that gillnets replaced longlines as the preferred fishing method. This change was in part caused by a ban on the sale of large school shark during 1972–85 in Victoria because the mercury content of the meat exceeded the former health standard (subsequently revised upwards). With the adoption of gillnets the core of the GHATF through Bass Strait effectively became a small mesh (6-6.5 inch) fishery for Gummy Shark which only opportunistically targeted school shark. At the margins of the GHATF in western SA and southwestern Tasmania where local stocks were less depleted the targeting of school shark persisted with larger mesh sizes (7-8 inch) until smaller mesh sizes (6-6.5 inch) were regulated throughout the fishery in 1997, and the ITQ system was implement in 2001 with a 350t TAC. School shark have also been taken as byproduct in the CTS and GABTS sectors, although this catch has been covered by the SESSF quota since 2001.

SharkRAG's assessments (since 1991) have consistently estimated that the School Shark population is below 20% of pristine levels (the SESSF HSP limit reference point). SharkRAG's recommendation in 2001 was to step the initial 350t TAC down to the level estimated to be the unavoidable incidental catch of the gummy shark fishery (240t) over 5 years. The management measures implemented by AFMA since the mid-1990s has aimed to stop all targeting of school shark and has reduced school shark catches from around 800t per annum in the mid-1990s to the current level of around <200t. School shark is now mostly taken as incidental bycatch when targeting gummy shark. In the 2011 season AFMA implemented a 20% rule for gillnet operators that limited school shark catches by individual operators to 20% of their Gummy Shark catch. This rule was implemented after extensive analysis of the catch data and was designed to ensure there was no targeting of school sharks.

Extensive closures to gillnetting have also been implemented since 2000 closing areas in Spencer Gulf, St Vincents Gulf, the head of the Great Australian Bight and west coast of Tasmania which were historically used to target adult School Sharks. Those areas complemented pre-existing closures to shark fishing within 3 miles off Victoria and inside all Victorian bays and inlets, and the inshore nursery areas of Tasmania which have been in place since the 1980s. Further closures were implemented in 2007 outside 183 m to shark gillnets and shark longlines and inside 183 m to auto-longliners were also aimed at reducing the bycatch of long lived mature age classes of school shark. In 2009 further closures around 150+ SA islands aimed primarily at reducing interactions with Australian sea-lions also closed >100 sq. nm of shallow water where adult school sharks were formerly targeted seasonally. In 2010 these sea lion closures were expanded, and an area off the Coorong closed because of dolphin interactions. The recent closure of the small mesh scalefish fishery in Corner Inlet in Victoria will also provide further protection to a formerly important school shark pupping area. Since 2011 the Australian sealion bycatch in the waters off South Australia has been managed using trigger limits that close relatively large areas for period for 18 months. These trigger limits have resulted in large proportions of South Australia being closed to gillnetting. In late 2012 further closed areas were introduced as part of the Commonwealth's Marine Reserve initiative.

2012 assessment

School shark has a long history of assessment that has been documented in previous species summaries. In summary, the results of the most recent full assessment (2009) were consistent with SharkRAG's previous assessments. The current biomass was estimated to be between 8-17% of pristine levels, well below the limit reference point of 20%. However for the first time the assessment clearly suggested that adult biomass levels have been stabilized by management measures implemented since the 1990s. Most sensitivity tests suggested that the School Shark resource is recovering at present catch levels, but some indicated that it is still in decline. However, given the long-lived nature of the species and the low levels of data now being gathered it is not yet possible to determine whether a rebuild has commenced.

A full assessment was not run during 2012, however, Shark RAG addressed a number of assessment issues. Firstly, the assessment model was run with some changes to the way the stocks intrinsic productivity was constrained. The 2009 assessment had artificially constrained this value, resulting in a very low level of stock productivity. The new runs of the model yielded higher estimates of productivity that are considered by SharkRAG to be more appropriate for this species. The outcome for the assessment was that the stock was able to recover more quickly than estimated by the 2009 assessment. Secondly, SharkRAG continued to express concern that the data used by the model was limited in its ability to provide an accurate picture of current trends in the stock. However, this model was adopted as the best indicator for stock status available.

The updated assessment indicated that the stock remained below the limit reference point (20% of pristine), but that it would rebuild to above that level in less than the biologically reasonable timeframe of three generations (66 years as recommend by SEMAC) with annual catches less than 225-250 tonnes (about 232 tonnes at 66 years, Figure 1). This is in contrast the results of the 2009 assessment where recovery to the limit reference point could only be achieved with annual catches less than would 26t.

SharkRAG remains concerned about the status of school shark, but notes that there are a number of signals that indicate that the stock is rebuilding (e.g. reports from gillnet fishers, scientific surveys). They also remain concerned that the assessment model struggles to provide a clear and unambiguous picture of the status of school sharks and are working to improve this situation through development of a current index of abundance, improved consideration of movement, and other refinements.

Recommended Tier Level

School shark is assessed against the Tier 1 harvest control rule (HCR1).

RBC calculation

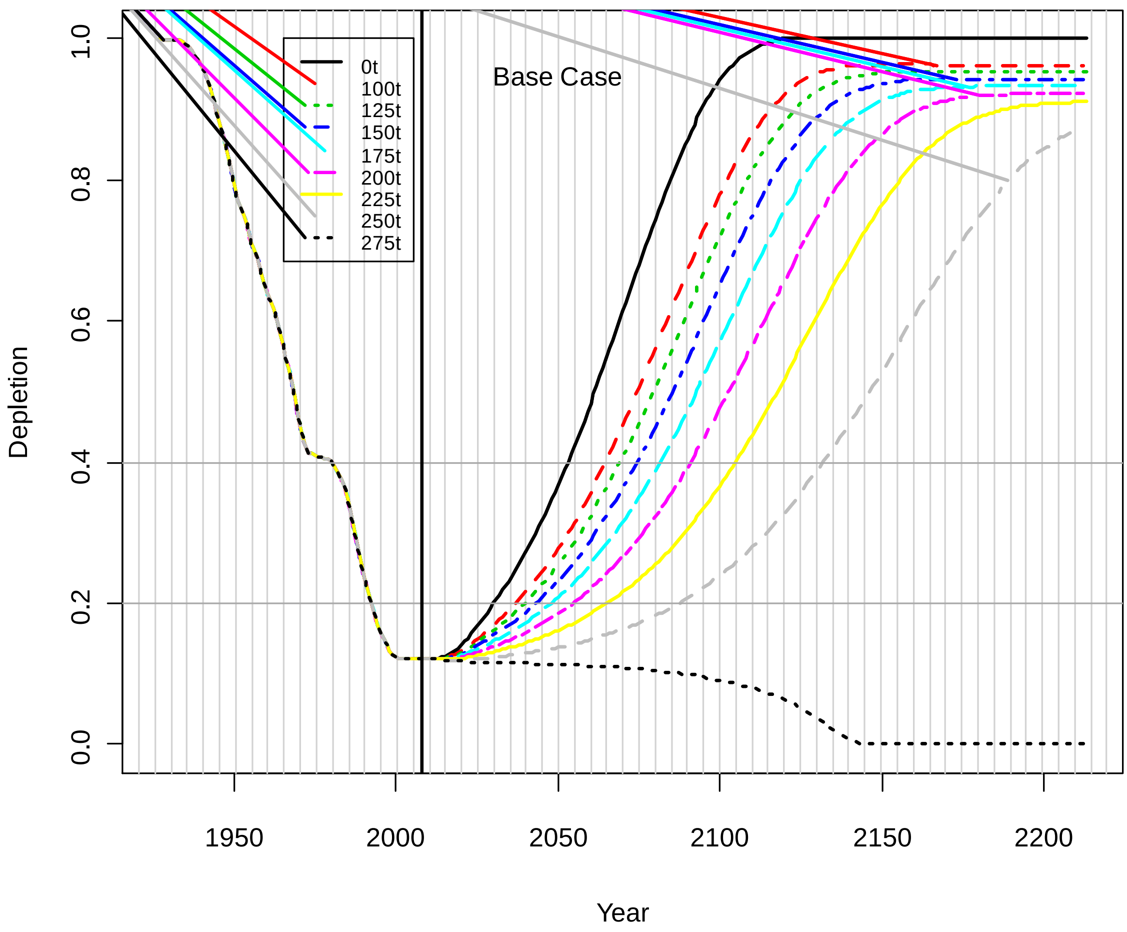
The stock remains below the Limit Reference Point of 20% of pristine levels so the RBC is zero. SharkRAG supported using the model to inform the incidental catch decision noting that School Shark should not be targeted. SharkRAG estimated that the incidental bycatch level was approximately 215 t. The estimate was based on several factors:

1. SharkRAG considers that the true estimate of unavoidable bycatch of school sharks is above the TAC levels set in recent years.
2. Based on the last full year of data (2011) the landed catch was 196. At this level the Integrated Scientific Monitoring Program estimated that approximately 9% of the catch is still discarded. This level of discarding is supported by data from logbooks (~14.7%).
3. Thus the estimate of the true unavoidable bycatch was calculated as the last full years catch and the estimated discards (215t).
4. This level of unavoidable bycatch is below the level which the assessment model indicates will lead to recovery within the SharkRAG recommended recovery timeframe (66 years).
5. SharkRAG continues to endorse the use of the 20% rule to ensure a lack of targeting of school shark and consider this an important component of the recovery of this species.

SharkRAG recommended no carryover of overcatch or undercatch.

Additional comments from the RAG

- SharkRAG reiterated its previous advice that maintaining the TAC at the 2012 level, or further TAC reductions, are likely to drive discarding, which while giving the appearance of a successful outcome in terms of landed catch this will not do enough to reduce fishing mortality.
- CSIRO analysis of effort data from 2011 suggested there is no evidence of targeting.
- During 2013 the School Shark rebuilding strategy will be subject to a formal review. As part of the review SharkRAG will review the rebuilding targets timeframe.


Base Case
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Depletion
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