



Australian Government

Australian Fisheries Management Authority

# School Shark (*Galeorhinus galeus*) Stock Rebuilding Strategy

## Revised 2015

## Executive summary

This *School Shark Stock Rebuilding Strategy 2015* (the Strategy) is a revision of the *School Shark Stock Rebuilding Strategy 2008* (the 2008 Strategy). This Strategy is created under the *Fisheries Management Act 1991* and is consistent with the *Commonwealth Fisheries Harvest Strategy Policy 2007*. The Strategy also meets requirements under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for a species listed as Conservation Dependent and for Wildlife Trade Operation accreditation for the Southern and Eastern Scalefish and Shark Fishery (SESSF).

This Strategy aims to rebuild school shark stocks to their limit reference point of 20 per cent of unfished biomass within a biologically reasonable timeframe of three generation times (66 years). This is to be achieved by measures including:

- closing areas to protect pups and breeding age school sharks as well as important habitat
- preventing targeted fishing for school shark by setting total allowable catches (TACs) at the minimum incidental bycatch level and implementing a maximum rate of school shark to gummy shark landings
- fishing gear restrictions to limit incidental catch
- minimum size limit of 450 mm
- improving knowledge of stock status, including data collection and monitoring.

The key challenge with school shark is measuring the abundance of the stock and monitoring rebuilding. Recent gillnet catch data and effort is not a reliable signal of abundance as fishers actively avoid school shark. A fishery independent method of measuring school shark abundance is commencing in 2014 using close kin genetics techniques. This should provide further information on school shark stock status over the next two to three years.

Catches in recent years have been reduced with 128 tonnes taken in 2012-13 and approximately 192 tonnes taken in 2013-14. Catch is currently constrained within an incidental bycatch TAC of 215 tonnes. The latest assessment update (2012) indicates that restricting catches to 215 tonnes will support recovery to the limit reference point within three generation times.

An annual review of school shark catch rates and biological information is conducted by AFMA's Shark Resource Assessment Group (SharkRAG). This process forms the main tool for monitoring the performance of this Strategy in meeting its objectives. The priority for the RAG is to support the close kin genetics project to develop a measure of abundance and ensure that measures currently preventing targeting and limiting mortality are practical and effective.



## Table of contents

Introduction .....	4
Rebuilding timeframes .....	4
Life history.....	5
Key threats.....	5
Status of resource .....	5
Objectives .....	5
Management actions to achieve the objectives.....	6
Current management arrangements.....	6
Area closures.....	6
Monitoring and evaluation.....	8
Stock assessments and data collection .....	8
Independent fishery monitoring .....	9
Fishery Independent Surveys .....	9
EPBC Act listing and reporting to the Department of the Environment.....	10
Reviewing the Strategy .....	10
Impacts of the Strategy.....	10
Economic impact.....	10
Consultation .....	10
Environmental impacts .....	10
References.....	11



## Introduction

Under the *Commonwealth Fisheries Harvest Strategy Policy 2007* (HSP), rebuilding strategies must be developed for all species which are below their biomass limit reference point. For school shark, the proxy of 20 per cent of the unfished biomass is used as the limit reference point.

In 2008 the School Shark Stock Rebuilding Strategy (the 2008 Strategy) was implemented because the stock was considered to be below its limit reference point. The development and implementation of the 2008 Strategy was also a condition of the 2007 Southern and Eastern Scalefish and Shark Fishery (SESSF) Wildlife Trade Operation accreditation under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This Strategy includes measures to prevent targeting of school shark while accounting for a level of incidental bycatch from fishers targeting gummy shark. Measures include:

- area closures to protect larger breeding school shark, pupping and nursery grounds, and important habitat
- a low incidental bycatch TAC. School shark has been managed under an incidental catch limit since 1997, when management measures aimed at eliminating targeted fishing for school shark were first implemented
- limiting hook numbers, gillnet mesh size and net height.

Historically school shark was targeted using both hooks and gillnets in the Gillnet, Hook and Trap (GHAT) sector of the SESSF. Low levels of school shark catch has also been recorded in the Commonwealth Trawl Sector, although school shark has not been targeted using trawl methods and catches are sporadic in nature. Consequently, this Strategy focuses on gillnet and hook fishing methods in the SESSF.

## Rebuilding timeframes

A rebuilding timeframe for school shark was not specified in the 2008 Strategy due to limited information at the time of writing. The HSP provides guidance for a 'typical' biologically reasonable timeframe for rebuilding as the lessor of 10 years plus one mean generation time or three times the mean generation time. However, the HSP recognises that there are likely to be a number of alternative time paths to rebuild a stock and that the optimal path has an economic component which is based on a trade-off between biological and economic considerations.

The 2012 School Shark Assessment indicated that rebuilding to the limit reference point:

- could not be achieved in one generation time plus 10 years (32 years) under any catch scenarios
- could be achieved in three generation times (66 years) with catches of up to 225t.

The Shark Resource Assessment Group (SharkRAG), the group primarily responsible for assessing school shark, provided this advice to the South East Management Advisory Committee (SEMAC) in March 2013. Subsequently SEMAC endorsed the rebuilding timeframe of three mean generation times (66 years), noting that it was in line with the guidance set out in the HSP.



In this Strategy AFMA has adopted the rebuilding timeframe to the limit reference point of three mean generation times (being approximately 66 years), in line with recommendations from SharkRAG, SEMAC and the example given in the HSP. This will be reviewed once the results of the close kin genetics study are available in two to three years.

## Life history

School shark are a long-lived species, living in excess of 50 years and not producing pups until around 16 years of age. Each mature female produces between 15 – 43 pups every three years, with females growing up to 50 per cent heavier than males. School shark are highly migratory species, feeding on a variety of schooling prey. Heavily pregnant females are commonly found in warm shallow waters, thought to promote embryo growth.

School shark are distributed around southern Australia mainly on the continental shelf and upper slope where they have been recorded from Moreton Bay (southern Queensland) to Perth, including Tasmania. School shark have been recorded to pup in a variety of sheltered bays and inlets in Tasmania and Victoria. 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 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.

## Key threats

Fishing pressure has been identified as the key threat for school shark in south eastern Australia, with historical fishing effort having depleted stocks to below 20 per cent of unfished levels. Catches peaked at approximately 2500 t in 1969 following the introduction of gillnets to the fishery in the mid-1960s. The initial Total Allowable Catch (TAC) for school shark was set in 2001 at 434 t, and has since been reduced to 215t for the 2014-15 season. The school shark TAC is set at a level that aims to allow incidental catch to be landed while preventing targeting of the species.

Coastal development and pollution, while not quantified, are also thought to have contributed to the decline in school shark recruitment and may impede recovery.

## Status of resource

The ABARES Fishery Status Reports 2013-14 classified school shark as overfished and uncertain if subject to overfishing with respect to the level of fishing mortality in the SESSF (Georgeson et al. 2014). Results from the most recent full quantitative assessment in 2009 estimated biomass levels to be below 20 per cent of unfished levels (Thomson and Punt 2009) although the assessment is uncertain.

## Objectives

The broad objective of this Strategy is to return the stock to ecologically sustainable levels and ultimately maximise the economic returns to the Australian community from the resource. In line with the HSP the specific objectives are:

1. to rebuild school shark in the area of the SESSF to the default limit reference biomass level ( $B_{LIM}$ ) of 20 per cent of unfished levels within a biologically reasonable time frame; three times the mean generation time (66 years) from the date of the 2008 Strategy;



2. having reached  $B_{LIM}$ , rebuild school shark in the area of the SESSF to the default maximum sustainable yield biomass level of 40 per cent of unfished levels ( $B_{MSY}$ ); and
3. once  $B_{MSY}$  is reached, use appropriate modelling to determine the target reference point ( $B_{TARG}$ ) biomass for school shark and a trajectory for the rebuilding of the stock to that point - OR rebuild to the default maximum economic yield level ( $B_{MEY}$ ) of 48 per cent of unfished stocks.

## Management actions to achieve the objectives

### Current management arrangements

School shark are a late maturing species, with large shark producing many more pups than smaller sexually mature shark. SharkRAG identified the protection of large breeding age females as the most important management measure to promote recovery of school shark. Current arrangements in place to reduce the impact of fishing on school shark include the closure of areas, gear restrictions, catch limits and size limits. Details of these management arrangements are discussed in more detail below.

#### **Area closures**

Protected coastal waters are important aggregation areas for school shark both as pupping and nursery grounds and for the migration of pregnant females towards the pupping grounds. All sites confirmed by research as pupping grounds have been closed to fishing. Areas of known school shark habitat have been closed to fishing through a blanket closure of all Victorian coastal waters and through the closure of specific school shark nursery areas in Tasmania. Additional closures of both coastal and deepwater habitat known to be important for school sharks were implemented during 2003 to 2005 specifically to protect breeding age school shark. These are the:

- head of the Great Australian Bight (all methods)
- temporal closure of areas south of Kangaroo Island (automatic longline only).

In response to a 2005 Ministerial Direction to recover overfished stocks, in June 2007 the following additional closures were implemented to protect school shark:

- waters deeper than 183m depth (gillnet closure)
- waters shallower than 183m (automatic longline)
- Kangaroo Island 1nm closure (gillnet, shark longline)
- Backstairs Passage closure (gillnet)
- 3nm Victor Harbour to the Victorian border (gillnet, shark longline)
- the Tasmanian west coast 130m closure (gillnet and shark hook).

Maps of all of the above closures are detailed in the Southern and Eastern Scalefish and Shark Fishery Management Arrangements Booklet which is available on the AFMA website at: <http://www.afma.gov.au/fisheries-services/fisheries-management-plans/>.



It was also agreed to protect important shark habitat in Bass Strait and inshore areas in western Victoria and eastern South Australia from trawling. This was accomplished by closures that were implemented from 24 July 2008.

A number of spatial closures have been implemented for gillnet operators in South Australia under the Australian Sea Lion Management Strategy (the ASL Strategy). These closures surround the immediate foraging area adjacent to Australian sea lion colonies and cover an area exceeding 18 500 km<sup>2</sup> when combined. In addition, large temporary (18 month) closures can be implemented if Australian sea lions are incidentally caught. Although these closures have not been implemented specifically for school shark, the reduction in gillnet effort in South Australia is likely to afford some level of protection in breeding areas.

### **Gear restrictions and selectivity**

Gillnets are highly size selective; mesh size of 150 – 165 mm for all Commonwealth gillnet operators ensures capture of middle-sized sharks whilst allowing escape of large breeding females and small sharks.

In October 2013, based on fishing industry advice, AFMA commenced implementation of a restriction on the height of gillnets to 20 meshes. The height restriction aims to limit the incidental catch of bycatch species including school shark.

Vessels using automatic longline to target scalefish in offshore waters are restricted to a maximum of 15 000 hooks primarily to minimize the impact of this method on bycatch species.

Hook fishing effort has increased significantly in South Australia following the implementation of the ASL Strategy under which gillnet operators have been allowed to use:

- temporary manually baited hook permits to target gummy shark in waters adjacent to South Australia (13 permits outside three nautical miles and five permits inside coastal waters).
- temporary automatic baiting hook permits to target gummy shark in waters adjacent to South Australia. Operators wanting to use this method are subject to a number of requirements including a 5 000 hook daily limit to minimise the impact of this method on bycatch species, limiting the ratio of school shark to gummy shark catches and 100 per cent monitoring by either observers or electronic monitoring systems.

### **Catch limits**

TAC limits have been set for school shark with the aim of eliminating targeted fishing for school shark and reducing incidental catch in the gummy shark fishery. The TAC is allocated to operators as Individually Transferable Quota (ITQ). If an individual catches more than their quota, they must obtain more quota or face compliance action. Under the HSP both landed and discarded fish must be considered in the setting of the TAC. AFMA and SharkRAG will monitor total fishing mortality and implement additional management measures if total fishing mortality exceeds the levels that will allow rebuilding of the stock.

Automatic longliners are restricted to a five tonne trigger limit for school shark which must also be covered by quota. This is designed to prevent auto longline fishers operating in the scalefish hook sector of the SESSF targeting school shark whilst still allowing incidentally caught school shark to be landed. In the event that the five tonne school shark limit is exceeded, AFMA consults with SharkRAG and SEMAC to determine whether further management action is required.



In 2011 AFMA implemented an additional measure to reduce instances of school shark targeting. The 20 per cent school shark to gummy shark catch ratio means an operator cannot catch an amount of school shark that exceeds 20 per cent of their gummy shark quota holdings. The ratio of school shark to gummy shark catches was limited to 20 per cent on the basis that school shark catches above this level would suggest the operator was targeting. AFMA, in conjunction with SharkRAG, will continue to review the effectiveness of the 20 per cent school shark catch ratio to determine if it meets the objectives for preventing targeted fishing for school shark whilst minimising unnecessary discarding.

Under the framework established by the 2000 Memorandum of Understanding between the Commonwealth and the states of South Australia, Tasmania and Victoria, state catches of school shark are limited through trip limits and gear and area restrictions.

## **Compliance**

AFMA has a dedicated compliance operation that includes the compulsory use of Vessel Monitoring Systems (satellite location monitoring) and a variety of other tools. Penalties for fishing infringements can be very high and can include the loss of fishing concessions and vessels. Consequently, fisheries management actions including quotas and fishery closures can be effectively enforced and existing prosecutions provide a strong deterrent to illegal activity. AFMA also undertakes annual compliance risk assessments of each fishery prior to determining its domestic compliance program for each year. Compliance resources are then apportioned across the fisheries in accordance with those risk assessments.

## **Other management measures**

- Minimum length – all school shark retained must exceed 450mm in length. This is designed to prevent the targeting of juvenile school shark.
- Processing standards for landing sharks - all sharks landed in the SESSF are subject to specific processing standards to ensure that species identification and lengths can be verified when landed. Shark finning is not permitted in the SESSF.
- Limited entry – the fishery is limited to the number of concessions that currently exist.
- Structural adjustment - the Commonwealth ran a structural adjustment program in 2006 and 2007 as part of a program to cease overfishing and promote the recovery of overfished stocks. Through this process 26 of the 88 gillnet boat Statutory Fishing Rights (SFRs) and 17 of the 30 shark hook SFRs were removed from the fishery.
- AFMA closely monitors discards and total fishing mortality. With the implementation of e-monitoring, AFMA can closely audit total discards of school shark. If total mortality is likely to exceed levels that support rebuilding, AFMA will implement additional management measures to keep fishing mortality at levels that support rebuilding.

## **Monitoring and evaluation**

### **Stock assessments and data collection**

The TAC for school shark has been set at a level which SharkRAG considered to be the best estimate of unavoidable bycatch. The current TAC is based on landed catch from 2011, prior to the implementation of the 20 per cent ratio and ISMP discard estimates of nine per cent (Upston and Klaer 2013).



The stock assessment model used for school shark relies on Catch Per Unit Effort (CPUE) data from the gillnet fishery to estimate relative trends in abundance. However, operators are actively avoiding school shark and this assessment does not provide a reliable measure of current abundance.

A fishery independent method of measuring abundance was supported in 2014 and a project using close kin genetics techniques has commenced. Results from this work are expected in 2017 and will provide an absolute measure of school shark abundance and allow ongoing independent monitoring of stock rebuilding.

In the meantime AFMA and SharkRAG will monitor all available data, including trawl CPUE, to assess whether current measures are supporting rebuilding. Standardised trawl CPUE has been analysed by SharkRAG and data presented in 2014 shows that that catch rates have been increasingly steadily since 2003. This data is consistent with increasing abundance of school shark and suggests that current measures are supporting rebuilding. This a positive sign but further work through the close kin genetic work is required to provide a reliable measure of abundance.

## **Independent fishery monitoring**

In the shark fishery, independent fishery data has been collected through the Integrated Scientific Monitoring Program (ISMP) since 1994. The ISMP is a data collection program which places independent observers on commercial fishing vessels to collect independent and verifiable information on fishing operations, catch and discards in the SESSF. From mid-2015 the on-board data collection program is being replaced with electronic monitoring.

AFMA has reviewed the data needs in the shark gillnet and hook fishery and is implementing sampling regimes to collect the required size and age data of quota species, including school shark. This will include port based sampling as well as on-board length measurements facilitated through e-monitoring systems.

E-monitoring is a system of sensors and video cameras capable of monitoring and recording fishing activities which can be reviewed later to verify logbook data. An electronic monitoring system typically includes three or more video cameras, a hydraulic gear sensor, a drum sensor, a GPS receiver, and a control centre.

The baseline audit rate for all fisheries with e-monitoring is 10 per cent of fishing effort. This will include analysis of full catch composition for each shot selected for review. Catch composition and discards on audited shots will be compared to logbook records with discrepancies flagged and reported to AFMA. A report summarising any discrepancies will also be provided to the fisher after each hard drive has been audited.

In some instances AFMA will audit more than 10 per cent of footage based on the level of risk. Any boat fishing in the Australian sea lion management zones will be subject to 100 per cent monitoring with higher levels of audits as outlined in the Australian Sea Lion Strategy. Other boats may have a higher audit level if they are considered to be a higher risk for misreporting.

## **Fishery Independent Surveys**

Trawl Fishery Independent Surveys (FIS) are conducted waters from Barrenjoey Point north to the westernmost point of Kangaroo island, in depths ranging from 50-700m, and the Great Australian Bight. FISs are important for a number of SESSF species where CPUE data is not



considered reliable. However, the results from the 2008, 2010 and 2012 SESSF FIS are of limited use for school shark, given the variability of the data.

## **EPBC Act listing and reporting to the Department of the Environment**

AFMA reports annually on the stock status of school shark and performance against the goals of this Strategy to the Department of Environment. AFMA also reports on the level of observer coverage and industry compliance with this Strategy.

## **Reviewing the Strategy**

This Strategy will be reviewed by AFMA, with input from SharkRAG and SEMAC, when the results of the fishery independent measure of abundance using close kin genetics techniques are available and in any case after five years.

## **Impacts of the Strategy**

### **Economic impact**

Economic impacts associated with the recovery process for school shark include the costs of monitoring, research and the stock assessment process. There is an additional impact on the fishing industry because no targeted fishing is permitted and only incidental catch TACs are set. Implementation of the 20 per cent ratio for school shark may also have an impact on industry as operators who incidentally catch school shark may be required to purchase additional gummy shark quota. It should be noted that some of these costs are expected to be offset in the longer term once the school shark stock has rebuilt and targeted fishing can recommence.

Management costs are apportioned between industry and the Australian Government under AFMA's Cost Recovery Impact Statement (CRIS) which reflects the Australian Government's Cost Recovery Guidelines

### **Consultation**

The Strategy has been developed with the assistance of:

- the Department of Agriculture and the Department of the Environment
- SEMAC and SharkRAG. Membership of MACs and RAGs includes management, industry, scientific and environmental interests
- key stakeholders including environmental non-government organisations, recreational fishers and the public through AFMA's website.

### **Environmental impacts**

Environmental and broader ecosystem impacts resulting from the implementation of the Strategy are anticipated to be positive. As previously stated the broad objective of the Strategy of returning school shark to ecologically sustainable levels is consistent with requirements under the EPBC Act.



## References

Department of Agriculture, Fisheries and Forestry (DAFF) (2007). *Commonwealth Fisheries Harvest Strategy Policy and Guidelines, September 2007*. [Online]. Canberra: DAFF. Available from: [http://www.daff.gov.au/fisheries/domestic/harvest\\_strategy\\_policy](http://www.daff.gov.au/fisheries/domestic/harvest_strategy_policy).

Georgeson, L, Stobutzki, I & Curtotti, R (eds) 2014, *Fishery status reports 2013-14*, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

Morison, A., Knuckey, I., Simpfendorfer C. and Buckworth, R. (2013) 2012 Stock assessment summaries for the southern and eastern scale fish and shark fishery. Report for the Australian Fisheries Management Authority, Canberra.

Peel, D., Bravington, M.V., Kelly, N., Wood, S.N. and I. Knuckey (2012) A Model-Based Approach to Designing a Fishery-Independent Survey. *Journal of Agricultural, Biological and Environmental Statistics*, Vol. 18 (1), 1-21.

Thomson, R.B., & Punt, A.E. 2009. *Stock assessment update for School Shark Galeorhinus galeus based on data up to 2008, including survey data (for SharkRAG 14-15 May 2009)*. Tech. rept. CSIRO Marine and Atmospheric Research.

Upston, J. and Klaer, N.L. (2013) Integrated Scientific Monitoring Program for the Southern and Eastern Scalefish and Shark Fishery – Discard estimation 2012 (DATA summary). CSIRO Marine and Atmospheric Research. Report for the Australian Fisheries Management Authority, Canberra.

