

School Shark Stock Rebuilding Strategy 2008

School shark is currently considered overfished in the Southern and Eastern Scalefish and Shark Fishery (SESSF). This stock rebuilding strategy is developed in accordance with the Commonwealth Fisheries Harvest Strategy Policy (HSP) which requires formal rebuilding strategies for all species that are below their biomass limit reference point. A specific biomass limit reference point (B_{LIM}) has not yet been established for school shark so the default B_{LIM} of B_{20} will apply to the species until stock assessments provide a specific B_{LIM} . The rebuilding strategy is created under the Australian Fisheries Management Authority's (AFMA) legislation and is designed to pursue the objectives set out in the *Fisheries Management Act 1991* and to be consistent with the Commonwealth Fisheries HSP. The development and implementation of this rebuilding strategy is also a condition of the SESSF Wildlife Trade Operation (WTO) accreditation under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Background

Stock Size

The 2001 stock assessment (*Punt & Pribac, 2001 SharkFAG/01/D03*) estimated the population of 1 year old and older sharks (i.e. juveniles, sub-adults and adults) in 1999 at approximately 1.1 million sharks. Inclusion of all age classes increases the estimated school shark population to approximately 2.3 million sharks. This assessment is currently being updated but the Shark Resource Assessment Group (SharkRAG), expects the new assessment will show the school shark population is still around the 1999 level.

Life History

School shark are a long-lived species, living in excess of 50 years, that does not produce pups until around 16 years old. Generation length for the species has been estimated to be 20-25 years. Each mature female produces between 15 – 43 pups every 3 years. Females grow about 50% heavier than males. School shark are highly migratory. They feed on a variety of schooling prey and seasonal aggregations of the species were historically targeted by fishers. School shark have been recorded to pup in a variety of sheltered bays and inlets in Tasmania and Victoria. 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. 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

The main threat identified for school shark is fishing pressure. Fishing for school shark began in 1927 in eastern Bass Strait using hooks, with catches reaching 400t to 500t by the mid 1930s. The fishery continued to grow throughout the 1940s, spreading to eastern South Australia and Tasmania as demand for both meat and shark liver oil grew. Demand for shark liver oil fell in the 1950s and catches declined until demand for meat grew again in the 1960s. Gillnets were introduced to the fishery in 1964 and catches grew rapidly, peaking in 1969 at over 2500t. The landing of large school shark was banned in 1972 due to concerns about mercury levels which saw a large shift in effort to gummy shark. Once the mercury ban was lifted catches of school shark again increased, mainly based on catches from Tasmania and South Australia.

Management of fishing effort was introduced in 1984 through limiting entry to the Southern Shark Fishery (restricting the number of fishing licenses issued). In 1988, a Management Plan was introduced to control effort through prescribing net lengths; at this time the annual catch of school shark was around 1200 - 1500t per annum. Due to concerns about the stock status of school shark, net lengths were further decreased in 1991 and catches fell to around 750 – 1000t per annum. Maximum gillnet mesh size was reduced from 200mm to 165mm in 1997 to prevent targeting of adult school shark. This reduced catches to around 400t per annum. An annual Total Allowable Catch (TAC) was introduced in 2001 for both school shark and gummy shark, to eliminate the targeting of school shark and manage the landings of school shark caught incidentally by fishers targeting gummy shark. The TAC for school shark has continually decreased from 434t at introduction to 240t in 2007 which was the level estimated at the time to be the unavoidable incidental catch from the fishery for gummy sharks. Since that time management has focused on increasing gummy shark catch rates and so reducing effort in the gummy shark fishery in order to reduce the incidental catch of school shark.

A TAC of 240t was considered by SharkRAG to be sufficient to promote recovery of school shark. The actual annual catch has been approximately 200t per annum which is equivalent to 25,000 school shark per annum or approximately 1.1% of the total population. The sustainable yield from the adult population is estimated by SharkRAG to be approximately 4-5%. In addition, the mesh size policy outlined above constrains the catch to being mainly sub-adults which are more resilient to fishing pressure as they are subject to higher levels of natural mortality than the long-lived adults. Modelling shows that constraining the catch to the juvenile and sub-adult part of the population increases the robustness of the stock such that harvest rates as high as 10-15% could be sustained by the age classes being fished. In this situation, restricting the catching of adults is intended to speed the recovery of the population by preserving the long-lived adults that have higher fecundity.

School shark remain a non-target species within the SESSF. School shark are only taken incidentally by fishers targeting gummy shark or occasionally caught in trawl nets.

The school shark TAC is set to prevent targeting of the species. SharkRAG consider the recommended biological catch (ie the catch that is considered to be sustainable based on stock assessments) and all known types of mortality eg State catches and discards. The TAC system requires all catch to be recorded (both discards and retained catch). Independent observers are placed on a percentage of vessel trips to provide verified data which can be compared to data obtained from unobserved trips. From the collected data, SharkRAG estimates unreported catches to be considerably less than 5% of the landed catch and comprised principally of sharks that have been damaged in the net by other sharks, leatherjackets, sea-lice or spoilage.

Habitat degradation

While fishing has been identified as the main threat to school shark, coastal development and pollution are also thought to have contributed to the decline in school shark recruitment and may impede recovery.

Scientific studies in the 1940s identified that school shark give birth to their pups in shallow, sheltered bays and inlets and that the pups feed on a variety of mainly seagrass associated fauna in the sediment. The most important pupping areas identified were around Tasmania, particularly in the south-east, and in Victoria, including Port Phillip Bay, Western Port Bay and Corner Inlet. These important pupping areas have been closed to targeted shark fishing (including all large mesh netting) but changes to coastal habitats, such as the draining of swamps and clearing of mangroves is thought to impact on the value of some of the pupping sites for school shark. Degradation of pupping areas may inhibit the recovery of school sharks in some regions of the fishery.

A number of targeted additional closures have been introduced to protect school shark over the years. These targeted closures are aimed at protecting adults when they are most vulnerable to fishing – in shallow coastal pupping grounds over summer. These measures, including the permanent closure of all Victorian coastal waters (out to 3nm) in 1988 and the designation of 11 school shark pupping areas in Tasmania in the early 1990s. Since 2003 many other closures aimed at protecting school shark have been introduced and these are described later in the rebuilding strategy.

Coastal habitats in the vicinity of the pupping areas are outside of the Commonwealth's jurisdiction. Actions to promote the recovery of school shark have so far focused on fisheries management for which the Commonwealth has responsibility. The recovery of school shark will be monitored. AFMA will consider the impact of onshore influences on the recovery of school shark and consider options for addressing such impacts. However, any such actions are expected to require the cooperation of State and local governments.

SharkRAG will be requested to advise on the benefit, feasibility and likely cost of undertaking research in relation to impacts from coastal development and pollution on pupping grounds and to examine low cost options, such as a review of already published work. Should further work be required AFMA will work with DEWHA to identify possible sources of funding and responsibility for progressing further research and any implementation action.

Status of Resource

School shark (and other shark species) biomass is measured by pup production; this is the number of pups produced annually by the population. This is considered to be the analogous to spawning biomass for scalefish species.

School shark has been assessed as overfished since the Bureau of Rural Sciences (BRS) commenced its annual assessments in 1992. The last complete stock assessment was undertaken in 2001, this assessment indicated that school shark pup production had declined to 9-14% of its level prior to the beginning of recorded catches in 1927. The current level of stock was estimated to be approximately 1.1 million 1 year old and older sharks (i.e. juveniles, sub-adults and adults). Following that stock assessment, the TAC for the incidental take of the species in the SESSF was progressively reduced to 240t over 5 years, or approximately 25,000 individuals. The objective of this reduction in TAC was to rebuild the mature biomass and pup production to above 1996 levels by 2024.

A comprehensive stock assessment of school shark has not been undertaken since 2001 because there has been no reliable indicator of stock abundance since targeted fishing ceased around ten years ago. The SharkRAG assessment in 2006 was consistent with earlier assessments indicating that the stocks were low, but did suggest that the decline in abundance had halted and that the stock was showing signs of stabilizing.

Catches and catch rates of school shark in the SESSF have been relatively stable since 2001, between 203t and 222t annually.

In 2007 SharkRAG designed and implemented a fishery independent survey for school shark which will allow comparison of current stock abundance with stock levels over the last three decades. During 2009 SharkRAG will use these new population data to update the stock assessment. The updated assessment will make it possible to project and define likely recovery trajectories. Although the current survey is yet to be completed and data analysed, catch rates of school shark being recorded for the site and mesh combinations surveyed historically, have increased.

Consultation

The key parties affected by the implementation of the rebuilding strategy are fishers operating in the Gillnet, Hook and Trap sectors of the SESSF. These fishers are represented on Gillnet Hook and Trap Management Advisory Committee (GHATMAC) and Shark Research Assessment Group (SharkRAG). Membership of MACs and RAGs includes management, industry, scientific and environmental interests.

SharkRAG considered the draft School Shark Rebuilding Strategy at its March 2007 and June 2008 meetings. GHATMAC considered the draft School Shark Rebuilding Strategy at its meetings in November 2007 and April 2008, and out-of-session in July 2008. Comments received have been included in this rebuilding strategy.

Objectives

Following the formulation of the Commonwealth Fisheries Harvest Strategy Policy, the objectives of this rebuilding strategy are:

1. To rebuild school shark stocks in the area of the Southern and Eastern Scalefish and Shark Fishery to the limit reference biomass level - B_{20} within a biologically reasonable timeframe.
2. Having reached B_{20} rebuild school shark stocks in the area of the Southern and Eastern Scalefish and Shark Fishery to the target biomass level - B_{40} (the default B_{MSY} point contained in the Commonwealth Fisheries Harvest Strategy Policy) within a biologically reasonable timeframe (a 'typical' biologically reasonable time is 10 years plus one mean generation time and one mean generation time for school shark = 20 to 25 years).

Once school shark stocks have recovered above B_{40} , management measures will remain in place to ensure the stocks grow to B_{MEY} or $1.2 \times B_{MSY}$ consistent with the Commonwealth Fisheries HSP.

SharkRAG will be asked to advise on a reference point for B_{MEY} , given school shark's low productivity, and if it is appropriate to do so, timeframes for reaching this point.

While recovery times are likely to be lengthy the rebuilding process incorporates regular review points. Although the Commonwealth Fisheries HSP provides proxies for a 'typical' timeframe to recovery as a guide, defining one that may be more appropriate for school shark to reach each of the objectives is dependent on updating the stock assessment. A survey will be undertaken during 2008 and the school shark assessment model will be revised by mid-2009. The revised school shark assessment model will then be used to determine possible timeframe for meeting each objective. In the medium term after the school shark stock assessment model is completed, SharkRAG will also be requested to provide advice on appropriate limit and target reference points for school shark, given its low biological productivity.

Management arrangements to achieve the objectives

School sharks do not give birth to pups until they are around 16 years old and large school shark produce many more pups than smaller mature fish. The reduction of mesh sizes in 1997 and the introduction and decrease in TACs for school shark has eliminated the targeted fishery for school shark and restricted catches to sub-adult animals.

Since that time SharkRAG identified the protection of large breeding age females as the most important management measure to promote recovery of school shark.

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 substantial 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;

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

In response to the Ministerial Direction to recover overfished stocks, in June 2007 the following additional closures were implemented specifically 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), and
- the Tasmanian west coast 130m closure (gillnet and shark hook)

Maps of all of the above closures are available on the AFMA website.

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.

Gear restrictions and selectivity

Gillnets are highly length selective such that small sharks swim through the meshes whereas large ones are deflected. The legal minimum mesh size of 152 mm, used predominantly in Bass Strait, and the legal maximum mesh size of 165 mm, used predominantly in South Australia, ensures capture of middle-sized sharks and allowing escape of large breeding females and small sharks. Whilst not completely preventing the catch of school shark, field studies conducted by Primary Industries Research Victoria (PIRVic) show the current mesh size restrictions prevent targeting of large breeding age school shark because they are too large to be effectively enmeshed by the available mesh sizes.

All automatic longline vessels are restricted to a maximum of 15000 hooks primarily to minimize the impact of this method on bycatch species. This restriction also assists school shark recovery as school sharks are highly susceptible to capture by hook methods. The total number of hooks set by auto longliners has progressively decreased each year for the last four years from ~ 10.4 million hooks in 2004/05 to ~ 5.9 million hooks in 2007/08.

There are a small number of shark hook Statutory Fishing Right (SFR) holders still operating in the fishery. As part of the structural adjustment program in 2006/07, 17 of the 30 shark hook SFRs were removed from the fishery. Most of those remaining are not actively used. There is minimal effort from this sector in catching sharks as the method is less effective at catching gummy shark than other methods. This sector will be monitored and any impacts assessed and addressed.

Catch limits

TACs have been set at levels for both school and gummy shark with the aim of eliminating the targeting of school shark and reducing its incidental catch in the gummy shark fishery. In 2001 SharkRAG estimated that 240t was the unavoidable catch of school shark from taking 1,800t of gummy shark at the catch rates then current. The school shark TAC was then progressively decreased from 327t in 2002 to 240t in 2007. When this was agreed in 2002 the school shark model indicated that implementing this strategy and maintaining the TAC at 240t for a period of time would lead recovery of the school shark population. 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.

The setting of a TAC for gummy shark directly limits the amount of effort in the fishery thus controlling the catch of a byproduct species such as school shark. In 2002 the gummy shark TAC was reduced specifically to reduce overall effort in the fishery to protect school shark rather than any concern over gummy shark sustainability. The TAC for gummy shark was reduced from 2159t in 2001 to 1800t in 2002. The aim of this was to drive gummy shark catch rates higher and thus gummy shark fishing effort and school shark incidental catches lower. Historic data suggest that in the medium term, the 1800t gummy shark TAC could be taken with half the current level of effort which with the elimination of targeted school shark fishing, would equate to half the level of incidental school shark catch. Ongoing monitoring by SharkRAG indicates the strategy is working; catch rates in the gummy shark fishery are rising and effort levels are falling. The number of days fished has fallen from around 13000 days per year 2000 - 2002 to below 11000 days in 2007. Over time this reduction in gummy shark fishing effort and rise in gummy shark catch rates should create a capacity to further reduce the TAC covering the incidental catch of school shark from the fishery if necessary.

Automatic longliners are restricted to a 100kg trip limit for school shark (for which they are required to hold quota). This is designed to prevent targeting of school shark by this method. A catch in excess of this limit can result in compliance action.

TACs are set for a number of species including school and gummy shark. The TACs can be set for up to 3 years but are reviewed annually. Under the Commonwealth Fisheries HSP both landed and discarded fish must be considered in the setting of the TAC. Current Government policy requires AFMA to account for discarding in the setting of TACs.

Some sharks and fish are known to drop out of nets as they are hauled to the surface. During the 1990s SharkFAG (now SharkRAG), commissioned research with the aim of quantifying the extent to which school shark mortality might be under-estimated due to this factor. However, the research proved to be inconclusive in part due to the relative rarity of drop-out but in part due to the inherent difficulty of studying the phenomena. Since that time SharkRAG has placed a low priority on this area research partly because

of the expense of research into this relatively intractable area of research, but largely because even a moderate but consistent rate of drop-out does not bias the trends being estimated through SharkRAG's stock assessment process. This is because drop-out (what ever the level) has been a consistent part of the gillnet fishery over time and so does not impact the trends recorded over time. Sensitivity analyses conducted by SharkRAG show that a constant level of unrecorded 'kill' such as drop-out will cause the actual size of the original and current biomass to be under-estimated while the estimated relative level of depletion is unaffected. Further advice will be sought from SharkRAG on appropriate methods to assess drop out and the cost effectiveness of such research.

Compliance

AFMA has a dedicated compliance operation that includes the compulsory use of Vessel Monitoring Systems (VMS) (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. Of note, in 2006 AFMA prosecuted a GHAT concession holder for catching above the quota held for gummy shark. AFMA stressed in the court case that by catching additional gummy shark it was also likely that there would have been additional catch of the overfished school shark. The concession holder was convicted and fined \$315 000.

Observer coverage is required on vessels operating within the SESSF. For methods catching school shark as a by catch species, the observer coverage is presently about 5-10%, which is considered adequate.

Under the SESSF Wildlife Trade Operation approval, AFMA is obliged to review observer coverage by 31 December 2008 to ensure that there is statistically robust monitoring, principally in relation to bycatch species considered to be at high risk after the conclusion of the environmental risk assessment processes. A review of the observer program is also required because of the reduction in the number of operators caused by the former Government's structural adjustment package. The requirements of the rebuilding strategy will be considered at this time.

AFMA 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. In 2006/07, the risk of taking protected species or misreporting by catch in the SESSF was considered low to moderate.

SharkRAG also monitors trends in the fishery which has proved effective in tracking changes in the fishery. Since the legislation of small mesh sizes in 1997 and the introduction of a TAC for school shark in 2001, SharkRAG's analysis has shown that effort levels on former school shark fishing grounds in waters deeper than 100m and in western South Australia, contracted sharply. This is an indication of the success of management measurements aimed at eliminating school shark targeting. Cessation of school shark targeting at that time has left the school shark stocks in remote areas of the fishery such as south-western Tasmania and the Head of the Bight, in a relatively lightly

exploited state compared to that depicted by the stock assessment. In 2003 SharkRAG provided advice to AFMA that after the introduction of a TAC for gummy shark there was an unexpected reduction in declared catch levels. This led to further analysis by AFMA which confirmed discrepancies in the reporting and led to targeted tightening of reporting standards in several ports.

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 (ie brought to land) 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.

Future management options

Substantial measures have already been implemented in the SESSF to promote the rebuilding of school shark stocks. Several of these measures, such as the new spatial closures implemented since 2007 have not yet had enough time for the stock to demonstrate measurable benefit. Monitoring of the stock is being undertaken and as mentioned previously, there are indications that the decline has halted and is possibly recovering. However, in the event that rebuilding of the stock does not occur, the staged approach of further actions outlined below could be investigated.

Stage 1

- All scientifically proven pupping grounds in Victoria and Tasmania are already protected, with targeted nursery ground closures in Tasmania and a blanket ban on gillnetting within 3-miles of the Victorian coastline. However, anecdotal evidence from fishers, supported by some of the scientific experts on SharkRAG suggest scientifically unrecognised pupping grounds may exist in coastal South Australian and western Tasmanian waters. An initial stage of a graduated response would be to conduct further research into the existence of as yet unidentified pupping grounds and continue liaising with the South Australian and Tasmanian Governments to protect any such inshore areas used as aggregation or pupping sites.

Stage 2

Identify areas that present a high risk of elevated incidental catch rates and investigate additional spatial or temporal closures to reduce fishing effort in these areas. Such closures could include coastal areas in spring and early summer which are used by pregnant females as they migrate towards coastal pupping areas, and deepwater canyon features at the shelf break. The latter of these are favoured feeding grounds of adult school shark and attract feeding aggregations as a result of being highly productive.

- Further reduction of the school shark TAC. The school shark TAC has already been used to reduce catches to less than 10% of historic catch levels. It is set based on the 2001 gummy shark effort level, which was estimated as being the necessary level to cover the actual unavoidable, incidental catch of school shark. Since that time SharkRAG's analyses have shown that fishermen have effectively modified fishing practices to reduce the catch of school shark and that catch rates of gummy shark have risen so that the number of days being used to fill the gummy shark TAC has declined by 15-20%. These changes should be creating the capacity to further reduce the school shark TAC if necessary without simply increasing discarding. As a second stage of a graduated response SharkRAG could repeat its analysis of the unavoidable level of school shark catch using recent levels of gummy shark effort and catch rates and this analysis could be used as the basis for further reducing the school shark TAC.

Stage 3

- Further reduction of gummy shark, pink ling and blue-eye trevalla TACs to reduce the incidental catch of school shark. School shark is unavoidably taken as incidental catch principally of gummy shark fishing, but also of auto-longlining for pink ling and blue-eye trevalla. These are significant commercial species with a GVP of approximately \$20 million annually. Having eliminated targeted fishing for school shark through legislated mesh sizes and TACs set on the estimated level of unavoidable incidental catches, the final phase of a graduated response would be to drive down incidental catch levels by reducing the TACs for the species being targeted when the incidental catches are taken. Such a measure provides a last resort because of the significant financial impact it will have on the fishery.

Timeframe and Decision Rules

The school shark stock assessment is to be completed by early 2009. Decision rules for the implementation of any additional management actions will be determined in light of the findings of this assessment. It should be noted that stock estimates can vary between iterations independent of actual stock changes due to the quality and quantity of data entered into the model. Consequently stock trends will form the basis of decision rules for the implementation of further action rather than highly uncertain estimates of absolute stock biomass. The timeframe for any further management action will also be determined in light of the findings of the stock assessment.

Performance Measures

The school shark assessment model as revised and agreed by SharkRAG will be used to determine the relative biomass level of abundance to be measured against the

reference points in the objectives. The index of relative abundance being used to currently estimate biomass by the assessment is pup production. In the case of school shark, pup production is also a direct index of breeding biomass. While B_{20} is the target biomass level, relative biomass estimates and trends produced by the model will be monitored against this target at this stage of the school shark rebuilding strategy. Stock trend will be the key performance measure determining the type and timing of further management action if required.

The Commonwealth Harvest Strategy outlines a 'typical' recovery time to rebuild stocks which is provided as a guide for use where information on a stock is lacking. While taking this into consideration, timeframes to reach each of the objectives of this rebuilding strategy will be recommended to AFMA and the MAC by SharkRAG once the school shark model is revised to be able to produce biologically realistic estimates of the time necessary to recover to each biomass level.

The school shark stock assessment model will be updated at least every 3 years once completed. If the school shark stock assessment model indicates that school shark are not meeting the projected recovery trajectory then this rebuilding strategy will need to be reviewed including any additional management measures.

The Bureau of Rural Sciences will review the status of school shark stock as part of its annual review of the status of Commonwealth fisheries. SharkRAG and GHATMAC will also review the school shark assessment model.

Data collection and Analysis

School shark assessment model

The school shark assessment model is the main method of assessing the status of school shark. This assessment model was developed during the 1990s using estimated trends in targeted catch rates as the principal index of school shark stock abundance. Since 1997 SharkRAG has expressed concern that managed reductions in the targeting of school shark through legislated mesh size reductions and low TACs would make it impossible to continue using targeted catch rates as an index of school shark abundance. SharkRAG recommended that alternative indices of abundance be developed so that the assessment could continue to be updated. Despite SharkRAGs advice a range of factors prevented alternative indices being developed and as a consequence the assessment model has not been updated since 2001.

In 2007 funding became available to conduct a survey and SharkRAG designed and commissioned the Southern Shark Survey, the results of which will be available in early 2009. The results will provide a fishery independent index of abundance that will be an important new input into a revision of the assessment model due for completion in early 2009.

In the future the stock assessment will be the primary tool for assessing the trajectory of the school shark population and through its revision being planned by SharkRAG a mix of new and old data sources will be incorporated as outlined below.

Age Length Frequencies

Previously the school shark model primarily used age and length frequency data for the periods 1986-87 and 1990-94. Vertebrae samples are also available for the period 1994-04 but had not been processed for ageing. These are scheduled to be aged as a matter of priority, along with age and length frequencies from the Southern Shark Survey currently being completed.

CPUE

School shark catch and effort data are collected annually from the State agencies (Victoria, Tasmania and South Australia) and the Commonwealth. These data are entered into the Southern and Eastern Scalefish and Shark Data Integration Management summary and Analysis System (SESSF-DIMSAS) from which six monthly updates are produced. The Shark Resource Assessment Group (SharkRAG) analyses these figures twice annually to monitor effort and catch rates in the fishery. Previously the assessment model only used estimated targeted catch rates as an index of abundance and this will remain the case for the period up until 1997 when management measures aimed at eliminating targeting began to be implemented. SharkRAG's advice is that sufficient time has now elapsed since the major management transition occurred (1997-2002) for it to be possible to develop a secondary 'modern' time series based on incidental catch rates since 2002. It may also be possible to develop an additional 'modern' time series based on the incidental catch rate of school sharks by trawlers. Prior to the implementation of ITQs for school shark, the trawled catch of school shark was not reliably identified or reported, but since 2001 this has changed and subsequently may provide an additional source of information about population trends since 2001.

Surveys

The Southern Shark Survey, a project being run by Dr. Terry Walker of PIRVic, has been underway since early 2007. The results of this survey, expected in early 2009, will provide a fishery independent index of abundance that can be used as a direct input into the school shark model, enabling comparisons to be made with surveyed catch rates of school shark estimated through comparable surveys conducted in the 1970s, 1980s and 1990s. The estimated trend in survey catch rates across the four decades will provide an important continuous time series which allow the discontinuous CPUE time series to be 'tied together'. The data collected from the surveys, which are using a wide range of mesh sizes, will also be used to revise estimates of gillnet selectivity and estimate the age and length composition of the population.

Fishery independent trawl surveys are being undertaken to provide an independent index of abundance of as many SESSF quota species as possible. The survey design was completed in the 2007/2008 financial year and the survey is being undertaken in 2008. Although this survey is not specifically designed to collect information on school shark in the long term it may provide an additional useful source of fishery independent population abundance data for this species.

During 2002 and 2003 an additional alternative cost-effective industry-based survey approach was trialed and preliminary results suggested it had considerable promise although continuing to develop the approach was given low priority and the initiative faltered. However the magnitude of the expenditure incurred through the Southern Shark

Survey has changed priorities and the industry-based approach where operators measure all the sharks and fish caught in the first shot of every trip, will be re-examined.

Enhanced monitoring

Fishing data includes two main components – that completed by the concession holder on the vessel and that completed by the first fish receiver as catch is landed. Fishing concession holders are required to record catch, fishing effort and fishing location among other things, on a shot by shot basis for all trips. Fish receiver reports verify catch information (species and weight caught), reported by fishing concession holders for each fishing trip. These sources provide a data set covering all fishing trips in the SESSF.

The AFMA observer program provides independent verification of fishing data including catches, discards and broader environmental issues. This provides an accurate data set which is considered along with catch records from concession holders in evaluating the fishery. It is possible that concession holders may under report discards and catches. However, any significant under reporting is likely to be detected through comparison of logbook, catch disposal and observer data.

Auto longline operations have been subject to an observer program for some years. Over 100 days of observer coverage was achieved in the auto longline sector during 2007/08, resulting in approximately 10% observer coverage of fishing activity in this sector. An observer program was introduced into the gillnet fishery in 2006 with 34 observer days achieved in 2007/08. The target number of observer days for the 2008/09 fishing year is 100. Observer coverage is being reviewed in light of reduced fishing concessions following the structural adjustment program and Wildlife Trade Operation requirements.

Onboard cameras have been trialed in the gillnet sector on one vessel and their viability need to be further explored. Subject to funding, if trials are successful and cost effective then onboard cameras could be used more extensively in the fishery in the longer term.

Integrated Scientific Monitoring Program (ISMP)

The Integrated Scientific Monitoring Program (ISMP) has been providing information on the quantity, size and age composition of quota species, including school shark, caught in sectors of the Southern and Eastern Scalefish and Shark Fishery since 1994. For depleted species such as school shark the use of non-targeted catch per unit effort (CPUE) such as that derived through the ISMP is an important performance assessment measure. Along with the four southern shark survey catch rates, the time series of ISMP observed school shark trawl caught catch rates provides an important continuous time series of population abundance data which continues across the transition in management arrangements and so within the context of the school shark assessment model 'ties' together the discontinuous fishery dependent catch rates time series.

Broader Environmental Aspects

Demersal gillnet fishing is considered a relatively benign fishing method in terms of its impact on benthic habitat and is selective in relation to target species. For bycatch species and listed species that interact with the gillnet fishery such as Australian sea lions, efforts to rebuild the school shark stock, such as area closures, will provide them additional protection.

Depth limits for gillnets provide protection for all deepwater species including sharks such as Harrison's Dogfish. The setting of conservative TACs to protect school shark reduces overall effort within the fishery and this results in reduced pressure on other species. Spatial closures provide protection to all species and these efforts complement the conservation efforts of MPAs and other spatial closures in the region.

Cost of Recovery Process

The cost and duration of the recovery process depends to a large extent on the outcomes of the revised school shark assessment model. To date the fishing industry within the Gillnet, Hook and Trap sector have borne the cost of the closures already in place and the reduced TACs for gummy shark and school shark. The cost of any data collection and analysis or other scientific research is divided between industry and Government on an 80/20 split. Should the results of the school shark assessment model indicate that there is a need for additional management measures, the benefits the benefits and costs of such measures will be analysed at that time.

Review

The status of school shark stocks is reviewed annually by SharkRAG and GHATMAC. SharkRAG and GHATMAC include representatives with scientific, industry and fisheries management expertise.

The annual review is undertaken as part of the process for recommending TACs. TACs are recommended for a range of species taken within the fishery including other shark species. The committees take into account available data from the fishery, other available information and the opinion of various experts. The committees also assess whether the necessary data are available, set research priorities and facilitate research to address information gaps. Monitoring and research of school shark will be assessed and reviewed through this process.

In addition to recommendations on TAC setting, SharkRAG and GHATMAC have responsibility for reviewing the success of the rebuilding strategy. In the event that the population is not stabilised or rebuilding under actions already implemented, this strategy outlines additional progressive actions that can be taken.

AFMA will report annually on stock status and performance against the goals of the rebuilding strategies to DEWHA. SharkRAG will assess performance of the stock against the goals of the rebuilding strategy as part of the review of stock assessments. AFMA will also report on observer coverage and compliance with the rebuilding strategy to DEWHA.

This rebuilding strategy will be reviewed within five years of implementation.