Southern Shark Monitoring Project 2002

Report to

Australian Fisheries Management Authority

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State Government Victoria
Department of Natural Resources and Environment

Victoria The Place To Be

Southern Shark Monitoring Project 2002

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Non-technical Summary

This document is prepared annually and reports on data collated or collected as part of the Southern Shark Fishery Monitoring Project. All three objectives of the project were met for 2001/02. These relate to collection, management and processing of (a) catch and effort data, (b) sex and length-frequency composition data from commercial catches, and (c) collection and storage of shark vertebrae for subsequent age determination.

The present report summarises the commercial catch length-frequency data available for the period 1970–2001 and the details of vertebrae collected for the period 1990–2001. Detailed breakdowns of catch and effort by State of landing and by broad region (Bass Strait, Tasmania and South Australia) are presented in separate reports. Similarly, interpretation and information on application of the data are presented in other reports. Lists of printed and electronic 'data reports' provided to AFMA, the State fisheries agencies, SharkMAC, SharkFAG, SIRLC, and agencies acting on behalf of AFMA, and the many *ad hoc* reports and publications produced as outcomes from the Monitoring Project are listed. Data summaries are also provided in response to authorisation of or request from shark fishers for individual vessel data.

List of Acronyms

AFMA	Australian Fisheries Management Authority
ABARE	Australian Bureau of Agriculture and Resource Economics
ABS	Australian Bureau of Statistics
ARF	AFMA Research Fund
BRS	Bureau of Resource Sciences
CSIRO	CSIRO Division of Marine Research
FIRTA	Fishing Industry Research Trust Account
FRDC	Fisheries Research and Development Corporation
FRF	Fisheries Research Fund
MAFRI	Marine and Freshwater Resources Institute
MRMB	Tasmanian Marine Resources Management Branch
SARDI	South Australian Research and Development Institute
SharkFAG	Southern Shark Fishery Assessment Group
SharkMAC	Southern Shark Management Advisory Committee
SSAAP	Southern Shark Allocation Advisory Panel
SSF	Southern Shark Fishery
SIRLC	Shark Industry Research Liaison Committee
SUOT	Swinburne University of Technology
SSFMDB	Southern Shark Fishery Monitoring Database
WAMRL	Western Australian Marine Research Laboratories

Background

Catch and effort monitoring

Data collection

Shark catch and effort data for the Southern Shark Fishery (SSF) have been collected historically from fishers, enforced, checked, partly validated and entered into various databases by the State fisheries agencies of Victoria, Tasmania and South Australia. Each of the three States presently has a database for managing its catch and effort data collected from a range of fisheries. The database is called CandE in Victoria, MAPPER in Tasmania and GARFIS in South Australia. Each year, copies of shark gillnet and longline data from these databases are transferred to the Southern Shark Fishery Monitoring Database (SSFMDB). The SSFMDB is maintained at the Marine and Freshwater Resources Institute (MAFRI) as part of the Southern Shark Monitoring Project and currently holds all catch and effort data available from the SSF for the period 1970–2001.

A single exception to this process occurred in Tasmania for 1988–95. During 1988, a special shark logbook form with provision for shot by shot data was introduced. The data from this logbook form bypassed MAPPER and were entered directly into the SSFMDB. However, during March 1995, this logbook form was replaced by yet a different shot by shot logbook form and the data from this return were entered into MAPPER before being down loaded to the SSFMDB.

A major change to the entire process occurred during 1997. AFMA adopted a shot by shot logbook-return (GN01, subsequently GN01A) to collect data from vessels with Commonwealth Permits and began developing the AFMA database called GENLOG. Because there is a legal requirement for fishers to complete the logbooks at sea where catch weights can only be estimated, AFMA also adopted the SAN2 return, which has to be completed at the end of each trip after the catch has been weighed.

Early 1997, AFMA issued the GN01 logbook return for vessels engaged in the Non-trawl Sector of the South East Fishery. Vessels with Commonwealth Shark Permits engaged in both the SSF and Non-trawl Sector were issued GN01 logbook returns and required to begin using the new return. Later, during July 1997, the remaining vessels with Commonwealth Shark Permits were issued the GN01 logbook return. The GN01A logbook has been issued for 124 vessels with Commonwealth Gillnet Permits and 37 vessels with Commonwealth Hook Permits. This logbook covers most of the total catch and has reduced the volume of data passing through the State databases. During 2001, management of the SSF changed from input controls by restricting gear use to a total allowable catch (TAC) administered through individual transferable quotas (ITQs) for gummy shark and school shark. Through an agreement under the Offshore Constitutional Settlement, operators who fished with a State licence and chose to be part of the SSF are required to submit GN01A returns. Those who chose not to be part of the SSF and continue to operate under a State licence with possession limits set for gummy shark and school shark continue to submit state returns. This further reduced the amount of data going through State databases; during 2001, 176 tonnes were produced from 398 vessels. Several changes to the details of the data collected have occurred with subsequent reprintings of the logbooks. Later versions of the logbook are referred to as GN01A.

Data management

The SSFMDB is a database developed under the Scientific Information Retrieval Database Management System. Initially developed at MAFRI during 1986 (Gason and Walker 1991), this system has been continually modified to cater for changing logbook returns and increasing demands for various files and summaries of the data. The system has also been gradually upgraded to take advantage of improvements in computer hardware and software. These enhancements have facilitated improved data accessibility, data validation and audit checks. The most recent modifications to the SSFMDB were undertaken during 1997–2001 to enable processing of the Commonwealth GN01A and SAN2 logbook returns.

As a routine process, data from the State databases (CandE, MAPPER and GARFIS) and, since 1997, the Commonwealth database (GENLOG) are copied to the SSFMDB. Once loaded in the SSFMDB, additional data validation, correction for multiple reporting from fishers, and standardisation of landed catch weights are undertaken. Landed catch weights of sharks are standardised to 'untrimmed carcass weight' (i.e. headed and gutted shark with all fins attached) where 'trimmed carcass weight' is weighted by a conversion factor of 1.13 for the period 1973–99 and by a conversion factor of 1.08 for the year 2000 and 2001. Weight of scale fish taken by shark gillnets and shark longlines is standardised to live weight. Another important facility of the SSFMDB is that it can weight for missing data. Also, through date of landing and vessel distinguishing mark, it can match catch, fishing gear and locality data with data from commercial catch length-frequency and vertebral samples collected mostly ashore. GN01A and SAN2 data are matched through vessel distinguishing-mark, prior-reporting number, and start and end dates for fishing trips. Computer validation of the data is undertaken in the SSFMDB to check that forms are complete, codes are valid, and values in selected fields and the ratios of values between selected fields fall within prescribed ranges. This is additional to various checks made in the State and Commonwealth databases and is used as a basis for querying fishers on data completeness and accuracy.

The SSFMDB provides up-to-date catch and effort data summaries and electronic data files essential for fishery management, licensing and stock assessment purposes. High-level data summaries are routinely required by AFMA, other fisheries agencies associated with management of the fishery, SharkMAC and SharkFAG. Detailed files of data on shot, daily and monthly bases are required by SharkFAG for stock assessment purposes. Data on vessel and fisher bases are required by AFMA and licensees for establishing fishing histories and access rights, and by ABARE for economic survey purposes. There is also a need for rapid response to requests for additional data extraction and validation by SharkFAG and to requests for ad hoc data summaries by AFMA, SharkMAC, SharkFAG, BRS, ABARE and other agents acting on behalf of AFMA.

Data resolution

The available shark catch and effort data are extremely complex and difficult to merge and manage. This is because the data have been collected by Victoria, Tasmania and South Australia and by the Commonwealth on 15 different logbook returns, which have been variously adopted and abandoned during the period from 1970 to 2001. These logbooks have different formats, different spatial (area and depth) and temporal (month, day and shot) resolutions and multiple reporting occurs. Adequate effort data for gillnets are not available from any State before 1973 or from Tasmania during 1977–87.

The logbook formats and the resolution of the data in all three States and the Commonwealth have been changed several times and all have had different logbooks with different formats concurrently during 1970–2001. All three States collected shark data at only a monthly resolution during 1970–72. Victoria then adopted a daily resolution, with a minor component of

the data at a monthly resolution, during 1973–78, and at a shot resolution during 1978–2001. Tasmania adopted a monthly resolution during 1970–95, with a small proportion at a daily resolution during 1973–76 and a shot resolution during 1988–95. Tasmania adopted the shot resolution for most shark data during 1995–2001. South Australia had a mixture of monthly and daily resolution during 1973–76 and 1978–2001, and mainly a monthly resolution during 1977–78. All logbook returns had facility to record location of fishing within a grid of 1 degree of latitude by 1 degree of longitude, and in some cases within one quarter of the 1-degree by 1-degree grid. Depth of fishing has been recorded on Victorian logbooks during 1973–2001, some Tasmanian logbooks during 1973–76 and 1988–2001, and some South Australian logbooks during 1973–76. The Commonwealth GN01 (subsequently GN01A) logbook return adopted during 1997 has the shot by shot resolution. This logbook has facility for recording depth of fishing and start and finish positions of each shot, or alternatively fishing location within a grid of 1 degree of latitude by 1 degree of longitude or within one quarter of the 1-degree by 1-degree grid.

Length-frequency catch composition monitoring

Sex and partial length measurements from shark landings have been collected in Victoria for the period 1970–2001 and in South Australia for the periods 1973–76 and 1986–2001. Less continuous data have been collected in Tasmania. This is now the longest running time-series of length-frequency data for any shark fishery in the world.

These data provide trends in sex and length-frequency composition of the catch and can be applied in various fishery assessment models. Mean length or mean weight of gummy sharks in the catch have been determined from the length-frequency data and used in the gummy shark stock assessments for estimating mortality parameters (Walker 1994a; Walker 1994b). The length-frequency data could be used directly in length-structured models, but so far they have not been used for this purpose.

Length-at-age catch composition monitoring

Length-at-age data are combined with time series of length-frequency data to produce time series of catch-at-age data, which have been used in catch-at-age analyses for estimating mortality and recruitment. These analyses have been used for estimating mortality of gummy shark (Walker 1986b; Walker 1992). These data have also been used directly in or to contribute to the validation of complex age-structured models for gummy shark.

Ideally length-at-age data are collected annually. These data are, however, available only for short periods in the Southern Shark Fishery and have had to be combined with length-frequency data collected for longer periods. Length-at-age data are available for gummy sharks sampled from Bass Strait during the periods 1973–76 and for both gummy shark and school shark sampled from Bass Strait and South Australia during 1986–87 and 1990–1993. Vertebral samples are available for 1994–2001 but have not been processed for age estimation.

Need

The MAFRI Shark Sub-Program has been undertaking the Southern Shark Monitoring Project at various levels of intensity depending on amount of funding since July 1989. The project was initially funded by the Australian Fisheries Service from FRF, then by AFMA from ARF, but is now funded by AFMA through industry levy.

During the 1970s and 1980s, the fishery was monitored by the State fisheries agencies and data were collated through FIRTA and FRDC funded projects undertaken by MAFRI. Shark catch data and some effort data available for the period 1932–56 are published in a scientific journal (Olsen 1959), and catch data for the period 1957–69 are published in the *Fisheries Newsletter* by the Commonwealth.

The Southern Shark Fishery produced 2333 tonnes, untrimmed carcass weight, of shark during 2001 at an estimated value of $16.3 million at the point of first sale (notably at auction and to processors) by fishers based in Victoria, South Australia and Tasmania. Most of the catch was taken by 35 gillnet vessels and 14 longline vessels issued with Commonwealth Shark Permits. An additional 435 State-only and Commonwealth SEF non-trawl licensed vessels reported landing a total of 191 tonnes of shark (Walker *et al.* 2002).

Sharks are often characterised as long-lived, slow growing and producing few offspring. These biological characteristics of sharks, the experience of declining catch rates in shark fisheries in many parts of the world and the frequently made assumption that sharks have direct stock-recruitment relationships have led to doubts about whether sharks can be harvested sustainably. These views recently led to the development of an 'International Plan of Action for Conservation and Management of Sharks' through a consultation process coordinated by the Food and Agriculture Organisation of the United Nations. The Guidelines for Implementation of this Plan of Action outline the requirements for ongoing monitoring of catch, catch composition and indices of abundance in shark fisheries (Anon 2000).

Monitoring in the Southern Shark Fishery meets most of the requirements of the International Plan of Action. Indeed the fishery has been identified by the United Nations Food and Agricultural Organisation (Bonfil 1994) and other international organisations (Anonymous 1997; Castro *et al*. 1999) as having implemented good management, research and monitoring procedures. Given the low productivity of shark fisheries generally, and the shift to managing the Southern Shark Fishery by quota allocations, detailed monitoring is essential to enable ongoing resource assessments for evaluating the effects of current and alternative harvest strategies on biomass, recruitment and future catches. Several factors further demonstrate the need for careful monitoring of the fishery. These include the severely depleted state of the school shark stocks (Punt *et al*. 2000; Punt and Walker 1998), the high dependence of the fishery on the gummy shark stocks, and uncertainty of the status of other species of shark (Walker *et al*. 1998). Details of the wide application of the monitoring data available for the Southern Shark Fishery in stock assessment and fisheries management are documented (Walker 1998; Walker 1999; Walker *et al.* 1998; Walker and Punt 1998).

Objectives

The Southern Shark Monitoring Project, funded annually, successfully met the three objectives for 2001/02.

1. Maintain Southern Shark Fishery catch and effort database for period 1970–2001 and update, collate and validate shark logbook data for 2001 and provide up-to-date data in the form of printed reports and electronic data files.

2. Continue to monitor the sex and length-frequency composition of gummy shark and school shark commercial landings in Victoria, South Australia and Tasmania during 2001/02 and provide up-to-date data summary reports and electronic data files for the period 1970–2001.

3. Continue collecting samples of shark vertebrae during 2001/02 for providing length-at-age data that can be used for estimating age composition of the gummy shark and school shark catches.

Methods and Results

Catch and effort monitoring

Data from shark logbook returns collected by the State fisheries agencies of Victoria, Tasmania, South Australia and the Commonwealth to the end of 2001 have been received electronically and entered into the SSFMDB. In the SSFMDB, the data have been partially validated (Hudson and Taylor 1998) through liaising with personnel of the State fisheries agencies and AFMA and with shark fishers to follow up data queries. The SSFMDB was further developed during 1997–2001 to provide facility for loading, entering and processing the available data for the period 1997–2001 collected on the Commonwealth GN01, GN01A and SAN2 logbook returns.

The catch and effort data are reported in detail by State of landing to the end of 2001 (Walker *et al*. 2001). The data are also presented by the broad regions of Bass Strait, Tasmania (south of latitude 41° South) and South Australia in the various annual fisheries assessment reports and stock assessment reports for gummy shark and school shark. In addition, various data reports and electronic files have been provided to AFMA, the State fisheries agencies, and agents acting on behalf of AFMA and shark fishers; these agents include CSIRO, BRS, ABARE, universities and consultants. A total of 159 such requests for data were responded to during 1993–2001 and 43 during 2001 (Appendix 1).

The commercial confidentiality of data provided by fishers and fish processors is protected by only reporting data summaries for a statistical fishing cell or fishing port when the catches are taken from a minimum of five fishing vessels. When providing data at the level of fishing vessel for research purposes, vessel-distinguishing marks are pseudonymised.

Sex- and length-frequency commercial catch composition

Sex- and length-frequency composition of gummy shark and school shark in commercial catch landings is routinely sampled by a team of trained fish measurers, employed on a part-time basis. The fish measurers operate in several fishing ports and regional fish processing plants in Victoria and South Australia. In Tasmania, sampling has occurred spasmodically and the number of samples taken is small. Samples were collected in Victoria during 1970–2001 and in South Australia during 1973–77 and 1984–2001.

The catch landings are sampled using purpose-built ‘shark measuring troughs’. The ‘shark measuring trough’ is V-shaped in cross-section, 1675 mm long and each of the two inside faces of the V is 100 mm high. It is constructed of aluminium-alloy, has flanged support stands at each end, and has a 25-mm-wide slot at the bottom of the V for about 50% of its length in the central region of the trough. The slot allows for drainage and the dorsal shark fins to protrude.

In preparation for taking a sample, a transparent celluloid strip and a plastic backing-strip are inserted together into a metal channel (1090 mm long by 45 mm wide) welded to one of the two inside faces of the ‘shark measuring trough’. A separate celluloid strip is required for each sample but the plastic backing strip is reusable. Species, sex and partial length of each of up to about 100 shark carcasses from a landing are recorded by a single hole punched on the celluloid strip; sample size is necessarily less than 100 when the catch comprises less sharks than this

number. The hole is punched on the celluloid strip within one of four parallel rows engraved 'gummy male', 'gummy female', 'school male' and 'school female' into the plastic backing-strip. Partial length is measured from the fifth gill-slit of the carcass to the base of the caudal fin, except in Victoria during January 1970–September 1985 where it was measured from the fifth gill-slit to the caudal sub-terminal notch.

For measurement, the shark carcass is placed dorsal side down in the trough. The fifth gill-slit and pectoral fins (pectoral girdle if fins removed) are then aligned with an engraved 'V' mark on the two inner faces of the trough. The 'V' mark (parallel to the front end of the trough) is situated between the front end of the trough (distance 295 mm) and the front end of the metal channel (distance 250 mm). Depending on species and sex of the shark being measured, the celluloid strip in the metal channel with the plastic backing strip is punched in the appropriate row with an awl at the base of the shark's caudal fin (the caudal sub-terminal notch in Victoria during January 1970–September 1985).

Data on species, sex and partial length, measured to the nearest centimetre, for each shark sampled are subsequently extracted from the celluloid strip and recorded on a data sheet. The data are then key punched and entered into the SSFMDB. Other data relating to the sample and sampled catch include distinguishing mark of vessel, sampling site, date of landing, date of sampling, weight of sharks in the sample and, where available, weight of batch of sharks sampled. Within the SSFMDB, these commercial catch sampling data can be matched by vessel distinguishing mark and date of landing with catch and effort data and assigned a geographic region, a fishing gear and a depth-range depending on the resolution required.

The partial lengths are converted to total length in the SSFMDB using several equations. In these equations l_{tl} is total length, l_{bcf} is the partial length from the fifth gill-slit to the base of the caudal fin, and l_{stn} is the partial length from the fifth gill-slit to the caudal sub-terminal notch, where the partial lengths and total length are expressed in millimetres. Because the equations are expressed in millimetres and because partial lengths are measured to the nearest centimetre, it is necessary to convert all lengths to millimetres (nearest 10 mm) for the calculations. For the majority of samples, the equation for gummy shark is

$$l_{tl} = a + b l_{bcf} ,$$

where $a = 26.5$ and $b = 1.61$ (Walker 1983), whereas the equation for school shark is

$$l_{tl} = a + b l_{bcf}{}^{c} ,$$

where $a = -73.2$, $b = 4.43$ and $c = 0.870$ (MAFRI, unpublished data). For samples collected in Victoria during January 1970–September 1985, a different equation is used because a different partial length was measured. The equation used for both species is

$$l_{tl} = a + b l_{stn} ,$$

where $a = 14.8$ and $b = 1.34$ for gummy shark (Walker 1983), and $a = 12.8$ and $b = 1.45$ for school shark (Walker 1986b).

Conversion of 1-cm partial length intervals does not convert neatly to 1-cm total length intervals; it leads to some missing total length intervals and to markedly increasing sample frequency in some other total length intervals. This is avoided by dividing each 1-cm total length interval into ten 1-mm sub-intervals and by dividing each 1-cm partial length interval into sub-intervals corresponding to the total length sub-intervals. The sample frequency within each 1-cm partial length interval is then distributed into its sub-intervals on the basis of the relative magnitudes of its sub-intervals (each <1 mm). The magnitudes of these sub-intervals at the two edges of a 1-cm partial length interval are likely to be smaller than the magnitudes of those positioned between them. The distributed sample frequencies are then adopted for the corresponding 1-mm total length sub-interval; in some cases the frequencies of the two edge sub-intervals from each of two contiguous 1-cm partial length intervals are summed. The sample frequencies within each 1-mm total length interval can then be summed for any required length-class. For the purpose of this report sample frequencies are aggregated into 100-mm total length classes.

Mean length of shark sampled, $\bar{l}_g$, for sex g is calculated by equation

$$\bar{l}_g = \frac{\sum_{i=1}^{I} n_{gi} l_{gi}}{\sum_{i=1}^{I} n_{gi}},$$

where l_i is the mid-length of length-class i (10-mm length-class in total length for the estimates presented); $i = 1,2,\ldots,I$ for I separate length-classes; and n_i as the number of sharks from length-class i sampled. Mean total weight of the sharks sampled, $\overline{w}_g$, for sex g was calculated by equation

$$\overline{w}_g = \frac{\sum_{i=1}^{I} n_{gi} w_{gi}}{\sum_{i=1}^{I} n_{gi}},$$

where

$$w_{gi} = a'_g l_i^{b'_g},$$

and where a'_g and b'_g are allometric parameters. In gummy shark, $a'_g = 4.52x10^{-9}$ and $b'_g = 2.96$ for males, and $a'_g = 1.22x10^{-9}$ and $b'_g = 3.16$ for females (Walker 1983), and, in school shark, $a'_g = 1.06x10^{-9}$ and $b'_g = 3.21$ for males, and $a'_g = 0.519x10^{-9}$ and $b'_g = 3.32$ for females (MAFRI, unpublished data). In school shark, similar equations are adopted for calculating mean carcass weight, where $a' = 17.7x10^{-9}$ and $b' = 3.41$ for both males and

females (Walker 1986a). For gummy shark, mean carcass weight of the sharks sampled, $\overline{w}_g^{'}$, for sex g is calculated by equation

$$\overline{w}_g^{'} = \frac{\sum_{i=1}^{I} n_{gi} w_{gi} r_i}{\sum_{i=1}^{I} n_{gi}},$$

where r_i is the ratio of 'untrimmed carcass weight' / total weight and given by the equation

$$r_i = a^{"} + b^{"} l_i$$

and where $a^{"} = 0.540$ and $b^{"} = 1.28x10^{-4}$ (Walker 1983).

The annual number of sharks measured, length-frequency composition and estimates of mean weight and mean length of shark in the catch from Bass Strait and South Australia during 1970–2000 are summarised in Table 1. These data indicate that the size of sharks in the catch declined during the first half of the 1970s but has remained remarkably stable since then.

Length-at-age catch composition monitoring

During 1990–2001, vertebral samples were collected from a total of 20,197 gummy sharks and school sharks landed in Victoria and South Australia, with a small number collected from Western Australia, Tasmania and New South Wales. Most were taken from commercial landings in fishing ports or regional fish processing plants, with a small proportion collected at sea. Of these, age estimates using published procedures (Moulton *et al.* 1992) have been made for 3718 gummy and school sharks collected during 1990–93 (Table 2) and are presented by species, sex and year for each of the zones Bass Strait and South Australia (Table 3). Data collected during 1973–76 and 1986–87 are reproduced from previous publication (Moulton *et al.* 1992) and included in Table 3 for completeness. The highest age estimates for gummy shark are 16 years for a female and 15 years for a male captured in Bass Strait. The highest age estimates for school shark are 20 years for a female and 17 years for a male captured in South Australia.

Reports and Publications from Project

During 1992–2001, there has been a large number of reports and publications using data produced as part of the Southern Shark Monitoring Project or indirectly from the project. These include 9 special reports to AFMA, 11 annual catch and effort reports to AFMA, 23 reports to SharkFAG, 10 published SharkFAG fisheries assessment reports and species stock assessment reports, and 28 other publications by members of the MAFRI Shark Team (Appendix 2). Numerous other reports and publications using data from the project have been produced by CSIRO, AFMA, BRS and ABARE through SharkFAG. Besides providing an essential component of the data for the work of SharkFAG, the project also provided essential data for the FRDC Southern Shark Tagging Project and the ARF funded Southern Shark Modelling Project. The data were used recently as part of an analysis to determine movement rates of gummy shark and school shark across the proposed route for the Basslink sub-sea cable from Victoria to Tasmania (Walker 2001).

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Fishers and processors currently or formerly associated with the Southern Shark Fishery are acknowledged for provision of data and cooperation with sampling commercial catches. Catch and effort data have been collected by the State fisheries agencies, but since 1997, AFMA has been collecting these data for those vessels issued Commonwealth Shark Permits. Acknowledgment for data and scientific input to the Southern Shark Monitoring Project is extended to current and former staff and fish measurers of the following agencies: AFMA, BRS, CSIRO, Fisheries Victoria, MAFRI, SARDI, MRMB and WAMRL. During the 1970s and 1980s, collation of catch and effort data, and collection of sex and length-frequency data and length-at-age data from sampling commercial landings were undertaken as part of several projects funded by FIRTA and FRDC and the States. During the 1990s, these data were collected as part of the Southern Shark Monitoring Project funded initially by the Australian Fisheries Service from FRF and subsequently by AFMA from ARF but recently by AFMA from industry levy.

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Table 1. Annual length-frequency for gummy shark & school shark during 1970–2001

Table 2. Number of gummy and school shark collected and aged during 1973–2001

Table 3. Length-at-age data for gummy and school shark captured during 1973–93

Appendix 1. Data Reports Provided to Outside Agencies during 1993–2001

Appendix 2. Reports and Publications from Monitoring Project during 1992–2001

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