



Department of
Primary Industries

Shark Meshing (Bather Protection) Program 2012-13 Annual Performance Report

Prepared in accordance with the requirements of the Joint
Management Agreements and associated Management Plan



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Coordinating editors:

Peter Gallagher
Senior Conservation Manager
Fisheries NSW

Vic Peddemors
Shark Scientist
Fisheries NSW

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Contents

Contents	i
List of Tables and Map	ii
Executive Summary	iii
Introduction	1
1 Reporting on Achievement of the Management Objectives	5
1.1 Progress in Implementing Measures Contained in the Management Plan	5
1.1.1 Controls on the activity (Part 3 of the Management Plan)	5
1.1.2 Observer Program (Part 4 of the Management Plan).....	5
1.1.3 Compliance Plan (Part 5 of the Management Plan)	8
1.1.4 Strategic Research and Monitoring Program (Part 6 of the Management Plan)...	11
1.2 Performance Indicators.....	23
1.2.1 Change in the number of human fatalities or serious injuries resulting from shark attack	23
1.2.2 Change in the number of major or minor occupational health and safety (OHS) related incidents reported by contractors or observers.....	23
1.2.3 Change in the number of entanglements with non-target species and threatened species, populations and ecological communities in the SMP.	24
1.2.4 Extent to which the reporting requirements are met.	27
2 Other Programs Complementing the SMP	27
2.1 The SharkSmart Public Awareness and Education Program	27
2.2 Aerial Surveillance	28
3 Other issues	29
3.1 Listing of new threatened species.....	29
4 Changes to the Management Plan	29
4.1 Recommended amendments.....	29
4.2 Adoption of amendments from the 2011-12 Annual Performance Report	30
References	31
Bibliography	31
Appendix 1 – Monthly catch summaries for the 2012-13 meshing season	32
Appendix 2 – Letter from the NSW Fisheries Scientific Committee	38
Appendix 3 – Letter from the NSW Scientific Committee	40
Appendix 4 – SharkSmart awareness and education program brochure	42

List of Tables and Map

Table 1. The 6 regions and 51 beaches of the SMP meshed in the 2012-13 season.....	3
Map 1. Location of Shark Meshing (Bather Protection) Program beaches.	4
Table 2. Observer hours and hauling days observed for 2012-13.	8
Table 3. Details of compliance measures undertaken during 2012-13.	10
Table 4. Progress on achieving the objectives of the SRMP.....	12
Table 5. Fatal and serious shark attacks in the SMP area from 2008-09 to 2012-13.....	23
Table 6. Total SMP entanglements for the 2012-13 meshing season.	25
Table 7: Non-target and threatened species entanglements for 2002-03 to 2012-13 and trigger point analysis for 2012-13.....	26

Executive Summary

Since the 2009-10 meshing season, the Shark Meshing (Bather Protection) Program (SMP) has operated in accordance with Joint Management Agreements (JMAs) and an associated Management Plan authorised by the *Fisheries Management Act 1994* and the *Threatened Species Conservation Act 1995*.

The JMAs and the Management Plan require an annual performance report to be prepared and submitted to the parties to the JMAs and relevant scientific committees convened under the State's threatened species legislation by 31 July each year. This report fulfilled those requirements, and was subsequently updated to ensure accuracy prior to publication.

There were 32 interactions with target sharks in the SMP during the 2012-13 season, comprised of 3 White Sharks, 2 Mako Sharks, 1 Broadnose Sevengill Shark, 2 Tiger Sharks (both released alive), 1 Bull Shark and 23 other whalers (2 released alive).

There were 72 interactions with non-target sharks¹ comprised of 19 Smooth Hammerhead Sharks, 1 Scalloped Hammerhead Shark, 9 Grey Nurse Sharks (3 released alive), 3 Australian Angelsharks (1 released alive), 3 Port Jackson Sharks (1 released alive), 3 unidentified Hammerhead Sharks, 29 Southern Eagle Rays (21 released alive) and 5 other rays (2 released alive).

There were 4 interactions with marine mammals and reptiles, comprised of 2 Humpback Whales (released alive), 1 loggerhead turtle, and 1 unidentified turtle.

Seventeen of those 108 interactions were with threatened species, namely Grey Nurse, White and the Scalloped Hammerhead Sharks, the Humpback Whales and the turtles.

The trigger point for the entanglement of non-target and threatened species was not tripped however the marked increase in the numbers of Grey Nurse Sharks taken over previous years is of concern. Similarly, two Humpback Whales were caught in SMP nets. Both animals swam away entangled in the nets, resulting in the loss of both nets. The fate of these animals is unknown.

The observer program was implemented with observers present during 19% of all net checks (hauls) undertaken by contractors. Funding from the SMP budget for aerial surveillance and the beach observation tower program during the 2012-13 season resulted in a reduction in total available funding for observer coverage in the 2012-13 reporting period.

The compliance plan was implemented and no compliance issues associated with the compliance plan were identified during the 2012-13 meshing season.

Implementation of the Strategic Research and Monitoring Program continued. Samples were collected as required to aid in scientific research and monitoring programs.

One shark interaction occurred at a netted beach during the 2012-13 shark meshing season. The interaction occurred at Dee Why and involved a shark bite on the lower deck of a surfboard. No human injuries were sustained. As such, this incident is classified as 'minor' and does not trip the trigger point related to 'human risk from shark attack'.

There were two occupational health and safety incidents during the 2012-13 meshing season which tripped the occupational health and safety trigger point. A review report will be prepared in response to these incidents to investigate and identify the cause of the problem and to make recommendations for remedial action.

¹ The term 'shark' refers to all species of shark, rays, skates and chimaeras unless otherwise specified

A range of other complementary programs were also delivered during the reporting period and are detailed in this report. These include ongoing work on the 'SharkSmart' awareness and public education program; and aerial surveillance as an adjunct to the SMP.

A range of amendments to the Management Plan were made in response to recommendations of last years' 2011-12 Annual Performance Report. The changes have been adopted and in accordance with cl. 52 of the Management Plan, the details are included in this annual report. In summary the changes consisted of:

- Updating agency names to reflect changes following the 2011 election,
- Renaming the Newcastle administrative region the Hunter region,
- Recognising the creation of the Sydney Central region.

The amendments were referred to the Scientific Committee and Fisheries Scientific Committee for comment and advice, and notification provided to the parties to the Joint Management Agreements prior to them taking effect.

In 2012-13 the program met the requirements of the JMAs and associated Management Plan.

Introduction

The Shark Meshing (Bather Protection) Program (SMP) is a public safety measure introduced in 1937 to reduce the risk of shark attack at the State's most popular public bathing beaches. Around 2 million people swim at these beaches each year. Under the current program, 51 beaches between Wollongong and Newcastle are netted by contractors using specially designed meshing nets to reduce the chances of shark encounters. No fatalities have occurred on a meshed beach in over 50 years, and only one fatality has occurred on a meshed beach since the program commenced.

Since the 2009-10 meshing season, the SMP has operated in accordance with Joint Management Agreements (JMAs) and an associated Management Plan authorised under the *Fisheries Management Act 1994* and the *Threatened Species Conservation Act 1995*.

The SMP is listed as a key threatening process by the Fisheries Scientific Committee (convened under the *Fisheries Management Act 1994*) and the Scientific Committee (convened under the *Threatened Species Conservation Act 1995*) as it adversely affects threatened species, populations or ecological communities and could cause species, populations or ecological communities that are not threatened to become threatened.

The Director-General of the Department of Premier and Cabinet (DPC) (formerly Department of Environment, Climate Change and Water) may enter into a JMA under s.121 of the *Threatened Species Conservation Act 1995* with another public authority. Similarly, the Minister for Primary Industries may enter into a JMA with a public authority under s.221V of the *Fisheries Management Act 1994*. The purpose of a JMA is to manage, regulate or restrict an action that is jeopardising the survival of a threatened species, population or ecological community.

Consequently, there are two JMAs for the SMP. One is between the Minister for Primary Industries and the Director-General of the Department of Primary Industries (DPI). The second is between the Director-General of DPC and the Director-General of DPI. The JMAs and associated Management Plan are publicly available from the DPI website: <http://www.dpi.nsw.gov.au/fisheries/info/sharksmart/meshing>

The JMAs and Management Plan were developed after broad consultation with stakeholder groups and the wider community during March to May 2009. The consultation document '*Report into the NSW Shark Meshing (Bather Protection) Program - 2009*' (the SMP Review) provided an environmental assessment of the impacts of the SMP and made key recommendations about ways to achieve the objectives of the program while reducing the potential impact on threatened and other non-target species, and to maximise the potential scientific benefits of the SMP.

The objectives of the JMAs are to:

1. Minimise the impact of shark meshing on fish and marine vegetation which are a threatened species, population or ecological community, and on marine mammals, marine birds and marine reptiles which are protected fauna or a threatened species, population or ecological community.
2. Ensure that shark meshing does not jeopardise the survival or conservation status of threatened species, populations or ecological communities, or cause species that are not threatened to become threatened.

To achieve the objectives of the JMAs, the DPI will:

- only carry out shark meshing in accordance with the JMAs and the associated Management Plan.
- only carry out shark meshing during the meshing season.
- ensure that nets are fitted with acoustic warning devices for cetaceans.
- require that contractors comply with by-catch reduction protocols and release protocols contained in the Management Plan and any release plans.
- continue research into methods of minimising by-catch of non-target species through implementation of the Strategic Research and Monitoring Program contained in the Management Plan.
- provide comprehensive release plans to the parties to the JMAs as required.

The objectives of the Management Plan are to:

1. Reduce the risk to humans from shark attack at beaches subject to the SMP, and, consistent with that objective:
2. Minimise the impact on non-target species and to ensure that the SMP does not jeopardise the survival or conservation status of threatened species, populations and ecological communities, or cause species that are not threatened to become threatened.
3. Minimise occupational health and safety risks to contractors and agency personnel associated with implementing the SMP.
4. Ensure that monitoring and reporting on the SMP is undertaken in a transparent manner.

In accordance with the Management Plan, the activity of shark meshing is defined as:

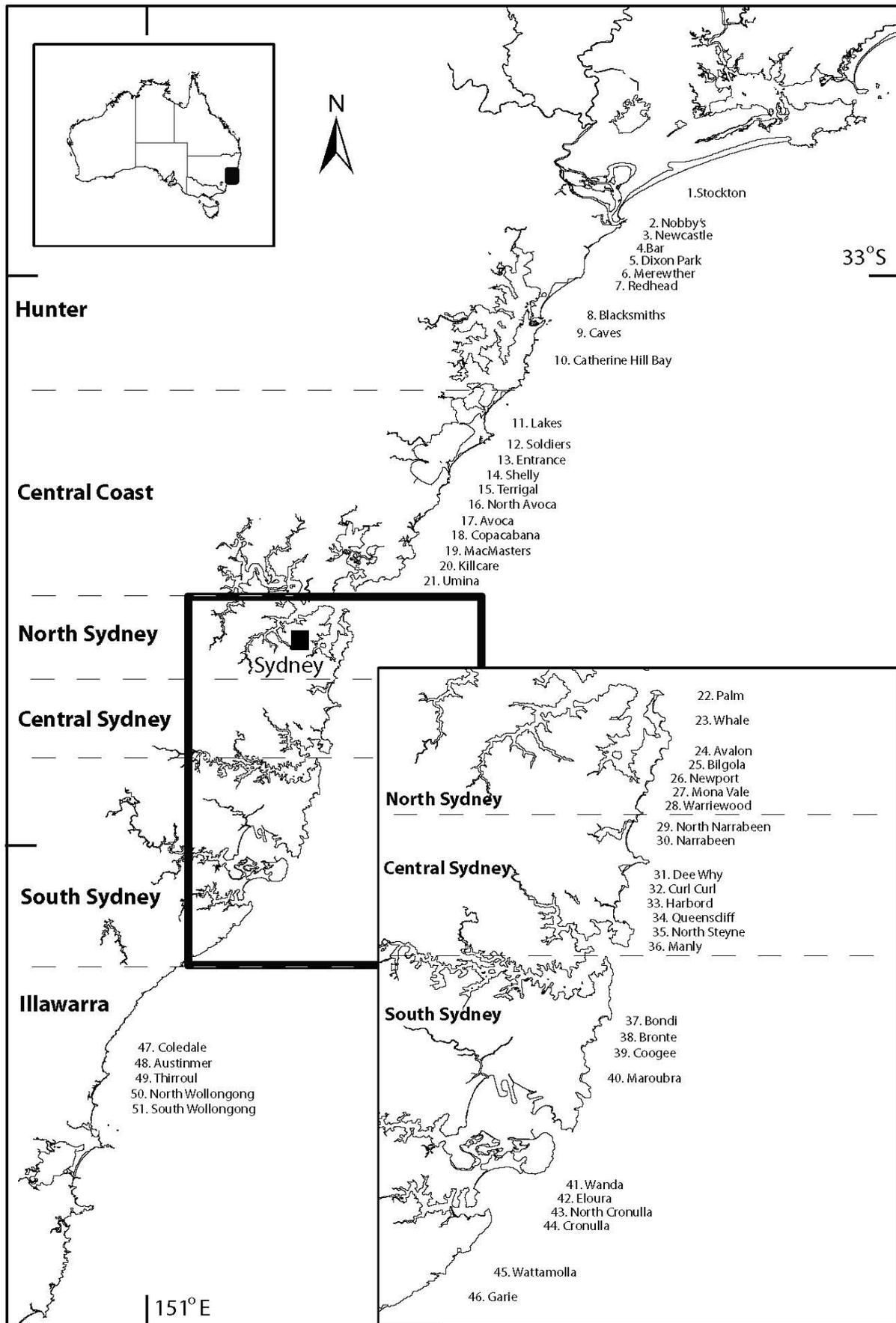
- The placing of nets around beaches or other waters at the 51 beaches listed in Table 1 of the Management Plan to protect the public from sharks.
- The activity is formally undertaken in NSW through the SMP.
- The SMP uses bottom-set synthetic filament mesh nets 150 m long and 6 m deep of 60 cm mesh size that are set generally parallel to the beach, anchored in approximately 10-12 m depth of water. The nets have a weighted bottom line (leadline) and a floated top line (floatline) and are identified by surface floats.
- The SMP includes all activities by contractors who set, haul, run, and clear the nets in accordance with requirements established by contract.
- The SMP also includes all activities by DPI associated with contract administration, compliance, supervision, observer programs, research programs, monitoring, and reporting.

Table 1 shows the 6 administrative regions and 51 beaches meshed during the 2012-13 meshing season (1 September 2012 to 30 April 2013).

Table 1. The 6 regions and 51 beaches of the SMP meshed in the 2012-13 season.

Hunter	Central Coast	Sydney North	Sydney Central	Sydney South	Illawarra
Stockton	Lakes	Palm	North Narrabeen	Bondi	Coledale
Nobbys	Soldiers	Whale	Narrabeen	Bronte	Austinmer
Newcastle	The Entrance	Avalon	Dee Why	Coogee	Thirroul
Bar	Shelly	Bilgola	Curl Curl	Maroubra	North Wollongong
Dixon Park	Terrigal	Newport	Harbord	Wanda	South Wollongong
Merewether	North Avoca	Mona Vale	Queenscliff	Elouera	
Redhead	Avoca	Warriewood	North Steyne	North Cronulla	
Blacksmiths	Copacabana		Manly	Cronulla	
Caves	MacMasters			Wattamolla	
Catherine Hill Bay	Killcare			Garie	
	Umina				

Map 1. Location of Shark Meshing (Bather Protection) Program beaches.



1 Reporting on Achievement of the Management Objectives

In accordance with the requirements of the JMAs, an annual review of the performance of the parties to the agreements is to be conducted by the Fisheries Scientific Committee convened under the *Fisheries Management Act 1994* and the Scientific Committee convened under the *Threatened Species Conservation Act 1995*. The Annual Performance Report (this report) is to be prepared by DPI on the operation of the program and forms the basis for both scientific committees' annual reviews. The report is also made publicly available.

The Annual Performance Report is required to:

- a) Document progress in achieving management objectives by:
 - i) Reporting on progress in implementing the Management Plan,
 - ii) Assessing and reporting on each performance indicator,
 - iii) Identifying any trigger points that have been tripped, and
 - iv) Identifying any overdue actions.
- b) Document outcomes of:
 - i) The Compliance Plan,
 - ii) The Strategic Research and Monitoring Program, and
 - iii) The Observer Program.
- c) Recommend any amendments to the Management Plan that may be required as a result of the performance of the SMP for the meshing year including:
 - i) The nature of the proposed change,
 - ii) The reason why the proposed change is required, and
 - iii) The effect of making the proposed change.

1.1 Progress in Implementing Measures Contained in the Management Plan

1.1.1 Controls on the activity (Part 3 of the Management Plan)

The Management Plan (cl. 14 - 31) sets out the controls on the activity by specifying the operational parameters of the program including: contract management, restrictions on waters, timing, gear and methods, and environmental protection provisions.

The Tender Specifications are consistent with the requirements detailed in the JMAs and Management Plan and underpin the requirements of the Compliance Plan. Any variation from the specific contract requirements are noted in this report (refer to section 1.1.3 Compliance Plan).

1.1.2 Observer Program (Part 4 of the Management Plan)

Establishment of the Observer Program

The Management Plan (cl. 32 - 36) requires an Observer Program to operate as part of the SMP, the purpose of which is to help qualify the delivery of the services provided under contract and quantify certain aspects of the activity including:

1. Contractor compliance with contract conditions.
2. Certifying that the observed meshings meet contract requirements.
3. Collection of data and biological samples
4. Detailing catch of target and non-target species.

Temporary employment

To satisfy the Observer Program requirements, two temporary employees were appointed in August 2012. One casual position worked on the two northern-most contractor boats (Hunter and Central Coast regions) for the 8 months of the 2012-13 meshing season. The second position was retained as a temporary full-time position for 12 months. This observer covered all three Sydney region contractors (Sydney North, Sydney Central and Sydney South), plus the Illawarra region. This position also assists the shark scientist with collation of data, dissections and cataloguing samples, purchasing and maintaining acoustic alarms, and other duties associated with the SMP.

Duties of the Observers

The duties of the observers are:

1. Observing the work involved in the setting, hauling or running of nets to ensure it is undertaken in accordance with all terms and conditions of the contract and the Management Plan.
2. Coordinating and performing the physical collection of biological samples for DNA analysis (or other projects).
3. Identifying shark species taken in net catches (cross-referencing with the provided identification manual).
4. Maintaining a written logbook and photographic image record of all animals that are caught in the nets while observers are present.
5. Collection and recording of biological samples from animals, as requested and including, but not limited to, genetic, teeth, vertebrae, reproductive and stomach content samples of sharks.
6. Liaising with the DPI shark scientist regarding collection of research samples.
7. Organising the collection of sampled material for delivery to relevant end-point.
8. Observing and verifying (by initialling the contractor's log book) the meshings observed each day against those recorded by the contractor.
9. Signing the monthly logbook to certify accuracy of the observed meshings.
10. Keeping a record of acoustic warning devices (dolphin pingers and whale alarms) – noting if devices are functioning when catches are reported, identifying and replacing non-operational devices, battery maintenance and replacement (including recording battery type), and providing that advice to the shark scientist.

Training of the Observers

The duties of the observers require that they have a good general knowledge of the meshing operations as specified in the Tender Specification and are proficient at shark identification. Most importantly, observers require training and equipment to undertake the work safely, particularly with regard to seagoing skills, assisting in the release of entangled animals and performing animal dissections and tissue sampling.

To ensure the observers were competent and resourced to safely undertake the duties prescribed in the Observer Program for the 2012-13 meshing season, DPI conducted a training day on 14 August 2012 at the Cronulla Fisheries Research Centre.

Contractors also attended the training day and were instructed in tagging procedures.

In 2012-13 contractors and observers were advised to pay particular attention to any hammerhead sharks caught in the nets in an attempt to ensure correct identification following the listing of the Great Hammerhead as a Vulnerable species and the Scalloped Hammerhead as an Endangered species in NSW on 25 May 2012.

Historically, hammerheads were only identified to genus level, particularly prior to improvements in species identification introduced in 1998 (Reid *et al.* 2011). Since this time however, records indicate that very few of either species have been captured in the SMP, and that Smooth Hammerheads constitute most of the catch. This is not unexpected given that the area of operation of the SMP is at the edge of the range of both listed species.

Observers will continue to focus on ensuring collection of samples from all deceased threatened and protected species as well as Bull Sharks, Blacktip Sharks, Australian Angelsharks and all species of hammerhead sharks. A new research project on Smooth Hammerhead sharks was initiated during 2012 and observers were requested to collect all deceased specimens of this species during the 2012-13 meshing season.

Provision of equipment

Prior to the commencement of the meshing period each observer was provided equipment and resources specific to the role including:

- Personal protective equipment such as:
 - Sun protection (e.g. sunscreen, sunglasses and broad-brimmed hat).
 - Wet weather gear - protective clothing for boat work.
 - Type-1 PFD life jacket (yoke style - inflatable).
 - High visibility work vest (Hi-vis vest).
- Safe work method statements for relevant tasks.
- Kits for specimen dissection and sampling.
- Shark identification resources.
- Marine mammal and sea bird identification resources.
- Mobile phone (for reporting captures, and arranging trip dates and times).
- Digital camera for photographing specimens taken in nets.
- Hand-held GPS devices for logging net locations.

Sundry items for administration and paperwork.

Allocated hours for observers

For the 2012-13 meshing season, each observer was allocated designated observer hours per meshing region as set out in cl. 34(2) of the Management Plan. The number of 'allocated' hours and the 'actual' hours worked during the reporting period, as certified by observers on monthly timesheets, are set out in Table 2.

Observers are mainly used on hauling days to observe catch and to assist contractors with obtaining samples for scientific research. Contractors must set the nets before the net can be hauled. During the hauling process the contractors check the net for any catch, clean the net and check for any damage. After the net is hauled it may be reset. On average observers were present on over 19% of hauling days. Details of observer coverage for each region are provided in Table 2.

Table 2. Observer hours and hauling days observed for 2012-13.

Meshing Region	Total No. of days setting and hauling	Total No. of hauling days	No. of hauling days observed	% of hauling days observed	Allocated Hours	Actual Hours
Hunter	117	106	33	31%	490	321.5
Central Coast	117	108	24	22%	630	300.5
Sydney North*	115	108	18	17%	315	121
Sydney Central*	135	133	20	15%	315	79
Sydney South*	167	160	18	11%	1225	72
Illawarra*	124	104	18	17%	350	58
Total	775	719	131	19%	3325	952

*Denotes the 4 meshing regions overseen by the full-time observer position in the SMP - time is allocated for this position up to 35 hrs per week for the entire meshing season and includes work on other SMP-related duties. Accordingly, no specific hours were allocated for the Sydney North, Central and South and Illawarra Regions – the full time observer was required to appropriately and equitably dispense his duties throughout those regions in consultation with the supervisor.

Variations to allocated hours

Downward and upward variations to the allocated hours can be expected due to inclement / unfavourable weather and unforeseen events. For example, the funding available for the Observer Program in the 2012-13 meshing season was reduced as a result of commitments to fund aerial surveillance and to continue the beach observation tower program. The program allocated \$30,000 which was shared between Lakes, Soldiers, Birubi and Tea Gardens/Hawkes Nest surf life saving clubs in 2012-13.

As a result of reduced funding availability, the overall percentage of haul days observed in the 2012-13 meshing season was 19%; down from 22% and 46% in the 2011-12 and 2010-11 meshing seasons, respectively.

Outcomes of Observer Program

Outcomes of the Observer Program in achieving progress toward the measures specified in the Management Plan for the 2012-13 meshing season include:

1. Catches of target and non-target species taken in nets were certified by the observer where they were present at the time and included in monthly catch data sheets (records held by Fisheries Compliance Unit, Ourimbah).
2. The observers provided accurate setting locations of all nets within the area of operation using hand-held global positioning units (GPS).
3. Details relayed to DPI and OEHL for all marine mammals and reptiles captured in nets.
4. Collection of samples of all animals as required and assistance in the delivery of whole animals.

1.1.3 Compliance Plan (Part 5 of the Management Plan)

A Compliance Plan as specified in Part 5 (cl. 37) of the Management Plan is required to ensure optimal compliance with the controls on the activity is achieved.

Audit and Compliance Checks in 2012-13

Compliance inspections were undertaken prior to and during the 2012-13 meshing season. For example:

- Nets and equipment were inspected prior to the commencement of the season to ensure all contractors were complying with current contract conditions.
- Covert operations were coordinated by the shark meshing supervisor as opportunities arose to do so in a cost efficient manner.
- Fisheries officers inspected the majority of the 51 SMP mesh nets from offshore patrol vessels during the season.
- Observers were requested to report any animals entangled in the nets and note any issues or concerns during the helicopter aerial surveillance in 2012-13.

Following a number of covert surveillance operations, meetings were held with contractors and observers when required to discuss some possible reporting inconsistencies. All matters of concern were resolved at the meetings with no further follow up required.

Beach meshing contractors are required to check their set net every 72 hours weather permitting. This commitment was met on the majority of occasions however there were two particular occasions, in September/October and December/January where, due to severe weather, nets remained set for up to a week.

The auditing and compliance checks undertaken during 2012-13 did not confirm any non-compliance with the current provisions of the SMP other than the tagging of one Greynurse Shark contrary to the requirements of the Management Plan. The contractor that tagged the Greynurse Shark was interviewed and advised that this species is not to be tagged due to historical research findings that have shown tags negatively impact the species.

Details of the compliance measures undertaken in the 2012-13 meshing season are set out in Table 3.

Lost and damaged nets

The following lost or damaged nets were reported during the 2012-13 season. Note that these reports include those where there was apparent interference with nets:

- Hunter contractor reported a Humpback Whale entangled in Dixon Park net on 16 September 2012. The NPWS whale disentanglement team was mobilised, however no trace of the whale or net were subsequently sighted.
- Sydney Central contractor reported on 19 September 2012 that nets at Harbord and Curl Curl were possibly damaged by an animal being cut out of the nets.
- Sydney South contractor reported on 6 October 2012 the Wanda net missing due to a Humpback Whale entanglement.
- Sydney South contractor reported on 9 October 2012 that the anchor appeared to be cut off the Bondi net.
- Sydney Central contractor reported on 10 October 2012 that the Curl Curl net was missing. The missing net was reported as retrieved off Dee Why on 31 October 2012 in approximately 30 metres of water with one anchor cut off.
- Sydney North contractor reported on 17 October 2012 substantial damage to the Avalon net apparently caused by a large animal.
- Sydney North contractor reported on 26 February 2013 that the Palm Beach and Warriewood nets were lost following bad weather conditions. The Warriewood net was later located and retrieved.
- Hunter contractor reported on 8 March 2013 that one anchor had been cut off the net at Bar Beach.

Table 3. Details of compliance measures undertaken during 2012-13.

Region	Inspection Type	Date
Hunter	14 nets inspected*	26/08/2012
Central Coast	13 nets inspected* plus 3 new nets being hung	26/08/2012
Sydney North	14 nets inspected*	25/08/2012
Sydney Central	9 nets inspected*	14/08/2012
Sydney South	13 nets inspected*	25/08/2012
Illawarra	15 nets inspected*	24/08/2012
Sydney South	6 nets observed# (Bondi to Maroubra, Elouera & Cronulla).	11/11/2012
Illawarra	All 5 beaches observed nets hauled and set.	7/9/2012
Hunter	Blacksmiths, Caves & Catherine Hill Bay beaches meshing operations observed.	3/9/2012
Central Coast	Umina, Killcare, Copacabana, Avoca & Terrigal beaches overt inspections.	5/9/2012
Hunter	Blacksmiths, Caves & Catherine Hill beaches meshing operations observed.	4/10/2012
Sydney North	Bilgola, Avalon, Whale & Palm beaches observed.	2/11/2012
Sydney North	Palm, Whale, Avalon, Bilgola, Newport, Mona Vale & Warriewood nets inspected by fisheries patrol vessel.	14/12/2012
Sydney Central	North Narrabeen, Narrabeen, Dee Why, Curl Curl, Harbord, Queenscliff, North Steyne & Manly nets inspected by fisheries patrol vessel.	14/12/2012
Sydney South	Bondi, Bronte, Coogee & Maroubra nets inspected by fisheries patrol vessel.	15/12/2012
Central Coast	Umina/Ocean, Killcare/Pretty, MacMasters, Copacabana, North Avoca, Avoca, Terrigal, Shelley, The Entrance, Soldiers and Lakes/Birdie nets inspected by fisheries patrol vessel.	16/12/12
Aerial surveillance - all regions	Helicopter aerial surveillance of all nets.	Each weekend and public holiday over the peak summer holiday period and every Wednesday from 19 December 2012 to 27 January 2013.

* 'Inspected' means physically inspected by the shark meshing supervisor.

'Observed' means covert surveillance of the netting operation.

Overall compliance

Compliance with contractual arrangements must be greater than the trigger point of 80% under the Compliance Plan.

Compliance exceeded 80% for the following tasks:

- Size, length, marking of nets 100% compliance.
- Pinger and whale alarms on 100% of nets

- Set times - the majority of hauls occurred within 72 hours of nets being set. There were periods of extended heavy weather which required nets to be left set longer than the required 72 hours.
- 100%* compliance with all covert and overt inspections

All issues were resolved to the satisfaction of the shark meshing supervisor, there was nil* non-compliance identified during the 2012-13 meshing season.

* Note: During 2012-2013 some inconsistencies were found in meshing logsheets submitted by contractors. Two contractors were interviewed regarding the inconsistencies. Specification requirements and responsibilities under the Shark Meshing Contract were made clear to those contractors and the observer.

1.1.4 Strategic Research and Monitoring Program (Part 6 of the Management Plan)

The purpose of the Strategic Research and Monitoring Program (SRMP) is to provide information that will lead to continuous improvement in the operation of the SMP and in achieving the objectives of the Management Plan.

The Management Plan categorises research priorities into 3 levels relevant to the risks identified through the environmental assessment process to provide information necessary to support the objectives of the Management Plan:

Level 1 (Planning): Within first 12 months of commencement of the Management Plan.

- i) Develop SMP research plan and identify budgetary requirements and funding sources.

Level 2 (Actions): Immediate and ongoing.

- i) Research associated with ongoing actions undertaken to implement the Management Plan.

Level 3 (Applied research): As required to meet the Management Plan objectives.

- i) Research requirements identified from the environmental assessment process to mitigate adverse impacts of the SMP.

Table 4 provides details of progress in achieving the objectives of the SRMP.

Table 4. Progress on achieving the objectives of the SRMP.

Level 1: Identify information gaps and research needs	
Level and Topic	Status and Comment
1.1 Review and report on research and information needs, funding requirements and possible sources of funding.	Status: Complete. Reported in the 2010/11 Report.
Level 2: Data collection and review of existing data	
Level and Topic	Status and Comment
2.1 Review and refine data collection methods	<p>Status: Commenced /ongoing.</p> <p>2.1.1: <i>Review data collection methods used in the SMP.</i></p> <p>Data collection methods are regularly reviewed and are adapted as technology and applicable uses are identified. The shark scientist informally reviewed sampling techniques used in the SMP and conducted a workshop on 14 August 2012 to ensure observers and contractors were trained to collect samples for DNA analysis and other uses. A complete wet lab training session was undertaken and a dissection kit was dispensed for each shark meshing boat.</p> <p>2.1.2: <i>Develop refined catch data forms and identification resources.</i></p> <p>The catch data reporting forms were refined and have been incorporated into the SMP since the 2010-11 meshing season with new forms and instructions for use dispensed at the pre-season training days for observers and contractors. OEH representatives were consulted with regard to any refinements that may be required for improved reporting of marine mammals, birds and reptiles. Weekly catch reporting to the Fisheries NSW compliance management officer continued in the 2012-13 meshing season.</p> <p>2.1.3: <i>Identify associated training programs for observers and contractors.</i></p> <p>The DPI shark scientist and the strategy leader identify training needs for contractors and observers and develop the annual training program in conjunction with other members of the shark meshing team. OEH representatives are also being consulted with regard to developing any refinements that may be required for improved identification and management of captured marine mammals, birds and reptiles under the Management Plan. The most prominent training required for the 2012-13 meshing season for observers and contractors was reiterating tagging procedures for nominated shark species and disentanglement procedures for non-target species from OEH. Pre-season training days will occur prior to all future meshing seasons.</p>
2.2 Review genetic samples to compare with reported species identification.	<p>2.2.1: <i>Review shark genetic samples held by DPI and cross-reference with reported species identification.</i></p> <p>Research is being conducted by the DPI shark scientist and Macquarie University undertaking molecular forensics on whaler sharks. The primary objective of this research is to obtain a better understanding of the historical composition of whaler sharks caught in the SMP. The main outputs of the research includes:</p>

Level 2: Data collection and review of existing data

1. Developing genetic markers suitable for rapid species identification of NSW sharks.
2. Genetically identifying sharks caught in the NSW meshing program during past years.
3. Correcting the SMP catch database to species level, particularly for whaler sharks.

Samples held by DPI are being cross-checked with DNA markers to determine the level of accuracy in phenotypical (visual) analysis. Where inconsistencies are identified, catch records are updated. Ongoing training of contractors and observers is designed to improve accuracy of shark identification, specifically for the whaler shark family which are inherently difficult to differentiate.

Further analysis of catch records in relation to reports by contractors, the SMP database, and the genetic species identification are currently underway.

2.2.2: Identify associated training programs/resources for observers and contractors.

Phenotypic analysis is being improved by provision of training to observers and contractors to identify common sharks encountered in the SMP. The use of the DPI publication '*Identifying Sharks and Rays, A Guide for Commercial Fishers*' was revisited during the August training day. This guide is designed to assist in the identification of sharks and rays potentially encountered in NSW waters (and the SMP). It contains simple, easy-to-use keys that highlight certain external distinguishing features of sharks and rays for identification purposes. The keys are further supported by detailed species information and illustrations so that identification can be made with confidence. Each contractor has a copy of the identification book for retention on their meshing boat.

OEH representatives are being consulted with regard to developing, sourcing and providing training that may be required for improved identification and management of captured marine mammals, birds and reptiles.

2.3 Review data on temporal and spatial factors affecting the operation of the SMP.

Status: Commenced and ongoing.

2.3.1: Review research being conducted by CSIRO Marine Research on White Shark movements.

DPI works closely with Mr Barry Bruce, principal investigator of the CSIRO White Shark Project, supplying data from White Sharks caught in the SMP and data of tagged sharks detected on DPI arrays of underwater acoustic listening stations. Although the CSIRO research is yet to be finalised, the results of these studies will be used to develop a greater understanding of this species and implications for the SMP. Early indications emerging from the research show that the main aggregations of juvenile White Sharks in NSW occur north of Stockton Beach and therefore outside the SMP area of operation. Juvenile White Sharks appear to be resident in the Stockton Bight region from mid August through early January; and resident in Victoria from January through April (Russ Bradford, CSIRO White Shark Project, pers. comm. July 2010). The CSIRO provides weekly updates of satellite-tagged White Shark movements to the DPI shark scientist.

2.3.2: Review existing data on other species (e.g. Tiger Shark, Bull Shark).

The report into the SMP in 2009 reviews existing data on Tiger and Bull Sharks. There have been no substantial increases in knowledge or research on Tiger Sharks in NSW that would benefit the operations of the SMP. However, shark biologists from DPI are contributing biological and genetic data to a Tiger Shark study being conducted in Queensland to ensure a holistic understanding of this species biology and ecology is obtained. The DPI shark scientist is collaborating on a study of age and growth of Tiger Sharks on the east coast of Australia using vertebrae including from animals caught in the SMP.

Bull Shark movement research is being conducted by DPI using acoustic tags and over 700 listening stations that DPI has

Level 2: Data collection and review of existing data

established along the NSW coast This research was instigated following the attack on a Navy diver in 2009 and will have direct relevance to the SMP and in understanding the risk presented by these animals. Preliminary results have been displayed at both the Sydney Aquarium and National Maritime Museum, and have been presented at various scientific symposia and workshops and in the public media via 10 presentations during 2012.

DPI scientists are collaborating with Queensland shark scientist's tagging and tracking Bull Sharks as the Bull Sharks tagged by DPI in the Sydney region are travelling beyond Townsville, while Bull Sharks tagged in Queensland are likely to travel into the SMP region. All data are being prepared for assimilation into the database administered by the national Australian Animal Tagging and Monitoring System (AATAMS) facility within the Integrated Marine Observing System.

2.3.3: Review existing data on spatial and temporal movements of non-target species.

The scientific literature on spatial and temporal movements of non-target species is regularly reviewed and all new information considered as an important component in decreasing potential impact of the SMP on near shore fauna. As a member of the OEH Marine Fauna Advisory Group and the IUCN Shark Specialist Group, the DPI shark scientist keeps abreast of new research outputs and management issues for species likely to be impacted by the SMP.

2.4 Review data on shark interactions and beach usage.

Status: Commenced and ongoing.

2.4.1: Access / review data collection by various organisations.

DPI shark scientist cross-references data held by the Australian Shark Attack File and the International Shark Attack File to report on any incidents associated with meshed beaches.

Number of sharks sighted by Surf Life Saving (SLS) NSW.

Region	Shark sightings	
	2011-12	2012-13
Hunter	23	21
Central Coast	14	12
Sydney	61	46
Illawarra	3	3
Total	101	82

2.4.2: Review data on beach usage rates and future usage predictions.

From 2006 to 2036 the population of NSW is projected to grow by over 2.3 million as natural increase and net overseas migration drive growth, while Sydney's population is projected to grow by 1.7 million people during this period (DECCW, 2009). An ongoing increase in beach usage in the area of the SMP can be expected into the foreseeable future given these predictions.

SLS NSW anticipates the visitation to beaches within the SMP area will increase proportionate to the general increase in population. SLS NSW is focussed on anticipated expansion in beach visitation outside the area of the SMP as roads and

Level 2: Data collection and review of existing data

housing subdivisions increase access to beaches in regional areas. SLS NSW is focused on areas outside SMP because SLS NSW considers that the risk of drowning is highest at unmanned/unpatrolled beaches as demonstrated by drowning deaths in the past few years.

SLS NSW provided the following beach visitation figures for the past five years for the beaches listed. The beach visitation is recorded at around 1 pm for the period from 25 September to 25 April of the next consecutive year. The average summer beach visitation within the area of the SMP over the five years is around 2 million people per annum. Over the past five years there has been a general upwards trend in beach visitations

Region	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	7 yr av. 06/07 - 12/13
Hunter	88,645	102,322	140,441	122,910	152,788	286,798	360,549	179,208
Central Coast	313,682	343,587	278,333	237,751	295,034	412,764	1,095,724	425,268
Sydney	1,090,482	1,363,137	1,586,513	1,543,121	2,051,599	1,783,692	2,483,113	1,700,237
Illawarra	25,494	40,837	47,579	123,940	82,543	105,273	132,628	79,756
Total	1,518,303	1,849,883	2,052,866	2,027,722	2,581,964	2,588,527	4,072,014	2,384,468

Beaches included in NSW SLS beach visitation data

Hunter Beaches	Central Coast	Sydney	Sydney cont.	Illawarra
Catherine Hill Bay	Avoca Beach	Avalon Beach	Palm Beach	Austinmer
Caves Beach	Copacabana	Bilgola Beach	Queenscliff	Coledale
Cooks Hill	Killcare	Dee Why	South Curl Curl	North Wollongong
Dixon Park	MacMasters	Freshwater	Warriewood	Thirroul
Merewether	North Avoca	Manly	Whale Beach	Wollongong City
Newcastle	Shelly Beach	Mona Vale	Garie	
Nobbys	Soldiers Beach	Narrabeen	Maroubra	
Redhead	Terrigal	Newport	North Cronulla	
Stockton	The Entrance	North Curl Curl	South Maroubra	
Swansea Belmont	The Lakes	North Narrabeen	Wanda	
	Umina	North Steyne		

2.4.3: *Develop better links between agencies and develop systems to optimise collection and use data.*

Better links have been developed between DPI, SLS NSW (volunteers and paid lifeguards), Council Lifeguard Services and the Australian Shark Attack File. These links were initially forged during the development of the 2009 Shark Meshing Report and cooperative development of the SharkSmart awareness and education program (August 2009) where each organisation provided input into the program.

Level 2: Data collection and review of existing data

	<p>Data and information is shared freely between the groups and coordination of information is increasing during other shark-related matters such as shark attack responses and the provision of 'real-time' information to surf life saving groups during the aerial surveillance trials.</p> <p>The accumulation and assessment of shark log data from SLS NSW and the aerial surveillance trials should lead to an improved understanding of what data is usable and beneficial to the operation of the SMP in achieving the objective of the Management Plan – and in beach safety generally.</p> <p>Better working relations have been established with OEH. Information on the catches of marine animals was conveyed in a timely manner to the appropriate OEH representative and whole carcasses were delivered for necropsy where requested. OEH is substantially involved in the training of contractors and observers to improve identification and outcomes for entangled marine mammals.</p>
<p>2.5 Review effectiveness of fishing operations used in shark control programs.</p>	<p>Status: Completed - ongoing.</p> <p>2.5.1: <i>Review NSW shark meshing net configurations.</i></p> <p>A research project investigating the SMP net configurations with a view to further reducing bycatch will be undertaken depending on available funding opportunities and contractor cooperation i.e. amendments to net configurations would be outside the scope of existing contracts. The research will aim to validate the feasibility of setting nets off the bottom to reduce bycatch of non-target demersal species of sharks and rays, pending future research funding.</p> <p>Nets in the Sydney Central region were set approximately 1m off the bottom during the 2012-13 season as a trial. This resulted in a substantial reduction in net damage and entanglement from free-floating macroalgae (sea weed), but historical catches of Batoids (rays and skates) are so low that changes in bycatch resulting from net configuration modifications are likely to require several years to determine with statistical certainty.</p> <p>2.5.2: <i>Review the application of other shark control measures for use in NSW (e.g. drum lines).</i></p> <p>A review of the potential for electric barrier technology to be used as a shark control measure off NSW was completed in 2007 (Peddemors, 2007). DPI shark scientist has over 20 years experience in electro-repelling of sharks and regularly reviews any new technologies that may assist in developing non-lethal shark control measures. Trials using the SharkShield™ with small whaler sharks (<i>Carcharhinus galapagensis</i>) indicated that the technology was not able to deter these sharks if recognisable bait was presented. More recently, trials using this technology against motivated White Sharks suggested that the behavioural response of white sharks and the level of risk reduction resulting from the electric field is contextually specific, and depends on the motivational state of sharks (Huveneers <i>et al.</i>, 2013). All data to date suggest that the electric shark repelling technology presently available may be of limited effectiveness in NSW coastal waters.</p> <p>The use of drum lines is not permitted under the operation of the SMP through the Management Plan as contractors are prohibited from using baits or lures.</p> <p>2.5.3: <i>Use outcomes to trial gear-related modifications of the SMP.</i></p> <p>No alternatives to physical shark control measures are considered viable to trial.</p>
<p>2.6 Develop methodologies for standardising fishing effort and analysing comparative CPUE data.</p>	<p>Status: Ongoing</p> <p>2.6.1: <i>Investigate the feasibility of standardising soak-times for shark nets.</i></p>

Level 2: Data collection and review of existing data

Standardisation of fishing effort is one of the most important issues to allow accurate assessment of the status of shark stocks via catch per unit effort (CPUE) methodologies.

The new JMA requirements assist in attempts to standardise soak times.

2.6.2: *Develop alternative approaches to standardised soak-times.*

A review of the SMP catch and catch rates using standardised fishing effort have been published (Reid *et al.*, 2011).

Level 3 Establish/support collaborative research (e.g. CSIRO, other government agencies and universities)

Level and Topic	Status and Comment
<p>3.1 Research needs identified (e.g. environmental impacts of shark meshing).</p>	<p>Status: Commenced and ongoing</p> <p>3.1.1: <i>Distribution, abundance, biology and ecology of target species affected by the SMP.</i></p> <p>Collaborative research initiatives have been established with the CSIRO White Shark Research Project investigating inter-annual variability in White Shark presence on the NSW coast using microchemistry of vertebrae. Since 2009-10 the CSIRO researchers have participated in White Shark dissections at the Cronulla Fisheries Research Centre as part of their investigations into the biology and ecology of this species. This collaboration led to completion of a BSc (Hons) thesis through the University of Technology entitled: 'Age, growth and movement signatures of the White Shark (<i>Carcharodon carcharias</i>) in southern Australia'.</p> <p>Additionally, genetic samples of White Sharks caught in the SMP contributed to the first estimation of effective population sizes for Australian White Sharks, and their population structure (Blower <i>et al.</i>, 2012).</p> <p>In collaboration with aerial surveys conducted by CSIRO and UTS, the 2012-13 DPI aerial surveys included surveys of the region between Seal Rocks and Stockton which represent the nursery grounds for White Sharks on the Australian east coast.</p> <p>Collaboration is ongoing with the South East Queensland Tiger Shark Research Project being conducted through the University of Queensland and the Queensland Department of Employment, Economic Development and Innovation (DEEDI). Vertebrae from Tiger Sharks caught in the SMP are contributing to an investigation into the age and growth of Tiger Sharks for eastern Australia. The specialist fish ageing facilities of DPI have been pivotal in this study.</p> <p>The DPI research project investigating the ecology and movements of Bull Sharks in NSW has forged strong links with researchers from Griffith University and James Cook University, Queensland, and the Queensland DEEDI.</p> <p>Several new research projects investigating whaler (Dusky, Spinner and Blacktip) sharks in NSW and Queensland waters have been initiated with collaborations via Macquarie University, James Cook University and the Queensland DEEDI.</p> <p>3.1.2: <i>Distribution, abundance, biology and ecology of non-target species affected by the SMP.</i></p> <p>Although non-target species have not formed the focus of DPI research efforts to date, research into Wobbegong Shark distribution, ecology and movements, is being conducted in collaboration with Macquarie University, Sydney Aquarium and OEH.</p> <p>A new research project has been initiated through Newcastle University investigating Smooth Hammerhead (<i>Sphyrna</i></p>

Level 3 Establish/support collaborative research (e.g. CSIRO, other government agencies and universities)

	<p><i>zygaena</i>) biology and fishery interactions as this species represents one of the highest shark catch species in the SMP.</p> <p>Research into the fishery, biology and ecology of Australian Angelsharks through Macquarie University has already provided new information for Australian Angelsharks in NSW that will be of direct relevance to the SMP.</p> <p>The DPI shark scientist has been nominally involved in advising on some Macquarie University cetacean research initiatives and, in collaboration with Macquarie University and OEH, has been involved in research into the efficacy of whale alarms on shark nets. As an international expert on acoustic dolphin deterrents (ADDs) popularly known as 'pingers' and member of the international World Wildlife Fund (WWF) Cetacean Bycatch Task Force, the DPI shark scientist is reviewing the efficacy of pingers in reducing dolphin bycatch in the South African shark nets in collaboration with the KwaZulu-Natal Sharks Board. The results of this work will be reviewed with respect to implications for the SMP.</p>
<p>3.2 Establish DNA library of shark species taken in the SMP to improve accuracy of identification.</p>	<p>Status: Commenced - ongoing</p> <p>3.2.1: <i>Conduct collaborative research with relevant research institutions.</i></p> <p>An analysis of historical DNA samples taken from sharks caught in the SMP is ongoing in collaboration with Macquarie University. DNA samples from sharks caught in the SMP are being incorporated in studies investigating east coast stock structure of various whaler sharks in collaboration with the Queensland DEEDI and James Cook University.</p> <p>3.2.2: <i>Develop SMP DNA library.</i></p> <p>A shark DNA library incorporating material from the SMP has been established by DPI and currently contains over 550 samples. The addition of new material from the SMP is ongoing. Through collection of genetic data the Australian Blacktip Shark, <i>Carcharhinus tilstoni</i>, which was previously not known from NSW waters (Boomer <i>et al.</i>, 2010) was identified in the SMP catch. Samples from Dusky Sharks (<i>Carcharhinus obscurus</i>), Sandbar Sharks (<i>C. plumbeus</i>), Common Blacktip Sharks (<i>C. limbatus</i>) and Spinner Sharks (<i>C. brevipinna</i>) are being used to develop genetic tools to determine the effective population sizes for these species.</p>
<p>3.3 Conduct scientifically-based shark attack risk assessment.</p>	<p>Status: Ongoing</p> <p>3.3.1: <i>Compile data from research relating to identified high-risk elements.</i></p> <p>Data is regularly being reviewed and assessed for potential inclusion in a database proposed to incorporate all activities and environmental conditions in both temporal and spatial fields. The historical lack of accuracy in any such data has previously hampered the establishment of a suitable database. Further research in this area requires access to adequate funding, but environmental data are being collected during aerial surveys with an emphasis on beach count data for various activities.</p> <p>3.3.2: <i>Apply standard risk assessment model (i.e. AS/NZ: 4360).</i></p> <p>A first attempt at applying a standard risk assessment model for potential shark interaction has been completed with the Royal Australian Navy for diving work in Sydney waters. Ongoing data collection on abundance, distribution and movements of potentially dangerous sharks are being collected for use in the development of future models. As any future models for risk assessment of shark attack will need to include data on bather use of NSW coastal waters, it is imperative that these data be collected in a scientifically robust manner.</p> <p>The ongoing education program SharkSmart supports the risk assessment model as it promotes safer bathing practices by informing bathers of the risks and ways to minimise the chance of a close encounter with a shark. During 2011, a prototype mobile application architecture was designed to draw on the key features of mobile computing devices such as smart phones</p>

Level 3 Establish/support collaborative research (e.g. CSIRO, other government agencies and universities)

	and tablet computers to see if the SharkSmart program could reach a wider audience and provide better information based on a personalised risk assessment model. Although various funding applications to further this program have historically been unsuccessful, there have been significant advances in knowledge about the potential for mobile content delivery of the SharkSmart education program. Alternative opportunities for funding were evaluated in 2012-13 for future applications.
3.4 Conduct morphometrics on sharks and other species caught in the SMP.	<p>Status: Completed and ongoing</p> <p>3.4.1: <i>Identify need for morphometrics in meeting the needs of the SMP.</i></p> <p>Quality morphometric data is needed to understand the efficacy of the shark nets in reducing interactions with potentially dangerous sharks. Also, the data provides information on the size classes and any possible size-based stock structuring of sharks off NSW. Morphometric data are included in assessment of shark bite to determine species and size of shark involved in the interaction, and contribute to data collected during research activities linked to the management of NSW commercial shark fisheries.</p> <p>3.4.2: <i>Include in research priorities document (1.1) if considered appropriate.</i></p> <p>Understanding morphometric data will allow better assessment of the potential impacts of the SMP on shark stocks and enable better management and conservation initiatives to be implemented. All research priorities are detailed in the Strategic Research and Monitoring Plan.</p>

Monitoring Program

1. Shark Meshing Contractor Catch Report.	<p>Status: Commenced and ongoing</p> <p>Weekly catch reports are required under the Tender Specification and telephone reporting continued during 2012-13 following commencement in the 2011-12 meshing season. Contractors provided weekly reports of catches or were called each Friday to obtain the report.</p>
2. Shark Meshing DPI Catch Summary Report.	<p>Status: Completed and ongoing.</p> <p>Monthly catch returns were submitted as required to the Fisheries Scientific Committee, Threatened Species Committee and OEH.</p>
3. Tagging program.	<p>Status: Commenced in 2010-11 meshing period.</p> <p>Shark and ray tagging educational material was developed by DPI in collaboration with the KwaZulu-Natal Sharks Board (KZNSB). Following discussions with the KZNSB, it was determined that the risk of impalement by the tail-barb is too high to allow contractors to tag rays.</p> <p>Tagging continued in 2012-13. Six sharks were tagged including: 2 Tiger, 1 Port Jackson, 2 Common Blacktip and 1 Grey nurse Shark. The contractor that tagged the Grey nurse Shark was interviewed and highlighted that this species is not to be tagged due to historical research findings that tags negatively impact this species in Australia.</p> <p>Turtle tagging may be initiated in the future with assistance from OEH.</p>
4. Routine DNA sampling and	Status: Commenced and ongoing.

Monitoring Program	
verification.	<p>Routine DNA sampling of all dead animals was undertaken.</p> <p>Sampling DNA from certain species of live sharks has not yet been undertaken and is still under development.</p> <p>Examination of the genetic material identified a new species, the Australian Blacktip Shark, in NSW (Boomer <i>et al.</i>, 2010).</p>
5. Shark vertebral and other tissue samples.	<p>Status: Commenced and ongoing.</p> <p>All threatened and endangered fish species were sampled or whole animals provided for research purposes and, where practically possible, all dead sharks were sampled for biological material.</p> <p>Note: A total of 70 sharks were caught in the nets during the 2012-13 meshing season including 32 target species and 38 non-target species. Eight sharks were released alive and, as such, were not sampled. Of the remaining 62 individuals, most were biologically sampled, unless the animal fell out of the net during the retrieval process before samples could be collected. All threatened and endangered fish species encountered by the contractors were sampled or whole animals retained for research purposes.</p>
6. Monitoring of all shark attacks.	<p>Status: Ongoing.</p> <p>When an attack occurs in NSW the DPI shark scientist or delegate interviews the victims where they are willing and seeks as much information and evidence of shark identification as can be attained. This includes scale-bar photography of wounds requested from surgeons, examination of wounds and damage to surf craft or clothing/diving materials that show evidence of bite marks and collection of any tooth fragments for analysis to help determine shark species.</p> <p>The DPI shark scientist also provides key media support following shark attacks in NSW providing balanced information to the community on the reasonable level of threat. This is particularly important where the media is supplied with false or misleading information by individuals seeking to sensationalise media coverage thereby potentially heightening public concern.</p>
7. Monitor technological advances in shark control measures.	<p>Status: Ongoing.</p> <p>Aerial surveillance trials have been undertaken (refer to section 2.2 Aerial Surveillance Trial).</p> <p>No new shark control measures have emerged recently that can reasonably be considered as a practical alternative to meshing.</p>
8. Patterns of movements of non-target marine animals.	<p>Status: Ongoing</p> <p>DPI is working with relevant agencies and reviewing information as it becomes available (e.g. threatened species management plans).</p>
9. Population trends and patterns of movements of dangerous sharks and attack behaviour.	<p>Status: Ongoing</p> <p>DPI has sourced information from relevant agencies and is developing trends and patterns of movements of dangerous sharks through research programs (refer to section 2.3 Review data <i>on temporal and spatial factors affecting the operation of SMP</i>).</p>
10. Patterns of recreational water contact activities in marine waters.	<p>Status: Ongoing</p> <p>DPI has reviewed the information that is available from relevant agencies (refer to section 2.4 Review <i>data on shark</i></p>

Monitoring Program	
	<p><i>interactions and beach usage</i>). Additionally, data collected during aerial surveys will assist in determining patterns of water contact activities at SMP beaches in NSW.</p>
<p>11. Threatened Species recovery plan reviews.</p>	<p>Status: Completed.</p> <p><i>Black Rockcod Recovery Plan</i></p> <p>The NSW Black Rockcod recovery plan was finalised and adopted in February 2011. Black Rockcod have never been reported being caught in the SMP nets and the Fisheries Scientific Committee's final recommendation to list the current shark meshing program in New South Wales waters as a key threatening process does not identify the SMP as a threatening process affecting this species.</p> <p><i>White Shark Recovery Plan</i></p> <p>The Commonwealth's National Recovery Plan for the White Shark (<i>Carcharodon carcharias</i>) was finalised in August 2013. The plan contains a specific objective to monitor and reduce the impact of shark control activities on White Sharks. Details of how the SMP is addressing the impacts listed in the draft plan is provided below under the relevant heading:</p> <ol style="list-style-type: none"> <i>Shark control programs to continue to report protected species interactions.</i> <p>All captures must be reported by contractors under the SMP tender specification. All catches are reported in accordance with the JMAs and Management Plan and the annual review report (this report) is made publicly available.</p> <p>DPI provides reports nationally and internationally by preparing and making the Annual Performance Reports publicly available on the DPI website www.dpi.nsw.gov.au.</p> <ol style="list-style-type: none"> <i>Maintain the current review process of the effect of shark control programs on other protected species.</i> <p>The SMP is reviewed annually (this report) and a full review of the SMP is scheduled under the JMAs to be completed within five years from 1 September 2009. The SMP will continue to operate in accordance with the JMAs and associated Management Plan.</p> <ol style="list-style-type: none"> <i>Continue biological recording and sampling of White Sharks caught in shark control programs.</i> <p>In accordance with JMAs and Management Plan, all White Shark captures are recorded and all live White Sharks are tagged and released. For deceased specimens, where possible the whole carcass is to be retrieved for necropsy and in all instances biological samples are collected from deceased captures.</p> <p>In 2012-13 biological samples were collected from all 3 deceased White Sharks. The 2 White Sharks from the Sydney and Illawarra regions were dissected with the CSIRO for a range of collaborative research projects.</p> <ol style="list-style-type: none"> <i>Develop a tagging program for white sharks caught in shark control programs, in conjunction with existing programs.</i> <p>In accordance with JMAs and Management Plan, all live sharks (excluding Greynurse Sharks) are to be tagged.</p> <p>In 2012-13 there were 3 White Sharks were encountered in the nets and all were dead. Consequently no White Sharks were tagged during the 2012-13 season.</p> <ol style="list-style-type: none"> <i>Continue to evaluate alternatives to lethal methods of shark control.</i> <p>DPI shark scientist will continue to monitor alternatives to the SMP for more details refer to section 2.5 Review effectiveness</p>

Monitoring Program	
	<p>of fishing operations used in shark control programs.</p> <p>6. <i>Improve coordination of sampling programs, ensuring shark control programs are included, and coordinate the collation of results and the storage of genetic and biological material collected.</i></p> <p>Samples of White Sharks taken in the SMP are collected, stored and provided for use in a range of collaborative research programs related to the biology, ecology and genetics of the species.</p> <p>Biological/ecological sample collection, storage and collaborations: CSIRO holistic sampling regime; Southern Cross University pollutant levels; University of New South Wales shark bite biomechanics; Deakin University shark microbiota and diet; University of Technology Sydney (UTS) & CSIRO White Shark age and growth; UTS & CSIRO White Shark nursery ground aerial surveys.</p> <p>Genetic sample collection, storage and collaborations: All deceased White Sharks are genetically sampled, with storage of material linked to morphometric data to contribute to national and international projects. A comparison of genetic samples with reported species identification is ongoing. For more details on the range of collaborative research being undertaken refer to section 3.1 (e.g. environmental impacts of shark meshing).</p> <p><i>Greynurse Shark Recovery Plan and Issues Paper - 2010</i></p> <p>The Commonwealth's Greynurse Shark Recovery Plan and Issues Paper 2010 was developed as part of the review process for the Greynurse Shark Recovery Plan 2002. The actions in the draft Recovery Plan are substantially based on the material that came out of a Greynurse Shark Workshop that was held on the 27 November 2009. The issues paper was reviewed to establish if any new or emerging threats relating to shark control measures have occurred. At the time of preparing this report the plan was on public exhibition until November 2013.</p>
12. Contractor compliance.	<p>Status: Completed for 2012-13 meshing season.</p> <p>This monitoring is conducted annually or when major non-compliance is detected. The shark meshing supervisor advised that no major non-compliance was detected during the meshing season. For more details refer to section 1.1.3 Compliance Plan.</p>
13. Monitor net locations by GPS.	<p>Status: Completed for 2012-13 meshing season.</p> <p>GPS location of nets was completed during 2012 for the 2012-13 meshing season.</p>
14. Shark Meshing Program Annual Performance Evaluation.	<p>Status: Draft completed.</p> <p>This Annual Performance Report provides an evaluation of the performance of the SMP under the Management Plan. As required under the JMAs all annual reports since 2009-10 have been made publicly available on the DPI website.</p>

1.2 Performance Indicators

The following performance indicators/trigger points were specified in the JMAs and associated Management Plan to determine if the SMP is meeting the defined objectives.

1.2.1 Change in the number of human fatalities or serious injuries resulting from shark attack

The trigger point for this objective is: one fatality or serious injury per meshing season on a meshed beach. Serious injuries are those that result in a threat to life or limb.

In the 2012-13 fiscal year there were seven shark incidents in NSW, none of which were fatal or serious (Table 5). Of these, two involved fishers bitten while releasing sharks. The seven incidents resulted in six minor injuries and did not occur at meshed beaches. The only incident to occur at a beach that is meshed as part of the SMP (Dee Why) involved a shark bite on a surf board and did not result in a serious human injury with only the surfboard being damaged.

Table 5. Fatal and serious shark attacks in the SMP area from 2008-09 to 2012-13.

Meshing Period	Fatal	Serious	Total
2008-09	-	3	3
2009-10	-	0	0
2010-11	-	0	0
2011-12	-	1	1
2012-13	-	0	0

Note: Shark attack information was cross-referenced with shark log records held by SLS NSW (Surf Life Saving Manager) and the Australian Shark Attack File (Curator: John West). These enquiries showed that no other attacks resulting in fatality or serious injury were recorded in the area of operation during the reporting period.

The trigger point for this performance indicator was not tripped during the reporting period.

1.2.2 Change in the number of major or minor occupational health and safety (OHS) related incidents reported by contractors or observers.

The trigger point for this objective is: one major or minor OHS incident – a major incident is one that results in 5 or more compensable days off work and minor incident is one that results in less than five days off work.

There were two major OHS incidents reported and recorded in the 2012-13 meshing season.

On 21 September 2012 the shark meshing observer for the Sydney/Illawarra regions received facial lacerations after slipping while at sea. The observer was returned to shore immediately for medical treatment of the wound that required suturing.

On 18 February 2013 the Central Coast Contractor required hospitalisation following a slip/trip injury whilst working aboard his boat moored at the Central Coast wharf.

The trigger point for this performance indicator was tripped as a result of these incidents and both cases will be investigated as part of a review report.

1.2.3 Change in the number of entanglements with non-target species and threatened species, populations and ecological communities in the SMP.

The trigger point for this objective is: entanglements of non-target species and threatened species over two consecutive meshing seasons exceed twice the annual average catch of the preceding 10 years for those species.

Catch records showed a total of 108 animals were reported entangled in the nets during the period from 1 September 2012 to 30 April 2013 (Table 6). This included the following threatened species: 3 White Sharks (dead), 9 Grey Nurse Sharks (3 alive, 6 dead), 1 Scalloped Hammerhead (dead), 2 Turtles (dead) and 2 Humpback Whales (alive). In the case of both whale entanglements, the nets were fitted with functioning whale alarms and dolphin pingers, and the animals swam away entangled in the nets before NPWS rescue teams could be mobilised. The animals were not seen again, and the nets were lost.

In addition, there were 63 non-target species taken including 23 Hammerhead Sharks (dead), 3 Australian Angelsharks (1 alive, 2 dead), 3 Port Jackson Sharks (1 alive, 2 dead) and 34 Rays (23 alive, 11 dead).

Species released alive included 3 Grey Nurse Sharks, 23 rays, 2 Tiger Sharks, 1 Australian Angelshark, 2 Common Blacktip Sharks and 1 Port Jackson Shark. Two Humpback Whales also swam away entangled in the mesh nets.

Batoids (rays and skates) continue to provide the largest component of all catches in each region (32% over all regions, 68% released alive). Whaler sharks (*Carcharhinus* sp.) accounted for 23% of all catches in each region and similarly Hammerhead sharks (*Sphyrna* sp.) accounted for 21%. Other species each contributed less than 10% of the total catch as detailed in Table 6, although capture of Grey Nurse Sharks increased over previous years and accounted for almost 8% of all captures (9 individuals with 3 released alive and 6 dead).

Catches of all non-target and threatened species taken in the 2012-13 season for the preceding decade are presented in Table 7. Note that Table 7 shows total entanglements (dead and released alive). No trigger points were tripped during the 2012-13 meshing season.

Table 6. Total SMP entanglements for the 2012-13 meshing season.

Scientific Name	Common Name	Hunter	Central Coast	Sydney North	Sydney Central	Sydney South	Illawarra	Released alive / fate unknown	Dead	Total	% of total*
Target Species											
<i>Carcharhinus brachyurus</i>	Bronze Whaler Shark						3		3	3	3
<i>Carcharhinus brevipinna</i>	Spinner Shark				1				1	1	1
<i>Carcharhinus leucas</i>	Bull Shark				1				1	1	1
<i>Carcharhinus limbatus</i>	Blacktip Shark			6	1	4		2	9	11	10
<i>Carcharhinus obscurus</i>	Dusky Whaler			2	2	1	1		6	6	6
<i>Carcharhinus falciformis</i>	Silky Shark				1				1	1	1
<i>Carcharhinus</i> sp.	Whaler Sharks		1						1	1	1
<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark						1		1	1	1
<i>Carcharodon carcharias</i>	White Shark	1				1	1		3	3	3
<i>Galeocerdo cuvier</i>	Tiger Shark			1			1	2		2	2
<i>Isurus</i> sp.	Mako Shark			1		1			2	2	2
Non-Target Species											
<i>Carcharias taurus</i>	Grey Nurse Shark	1	1	1		5	1	3	6	9	8
<i>Sphyrna</i> sp	Hammerhead sharks						3		3	3	4
<i>Sphyrna lewini</i>	Scalloped Hammerhead					1			1	1	1
<i>Sphyrna zygaena</i>	Smooth Hammerhead	5		6	4	1	3		19	19	18
<i>Squatina australis</i>	Australian Angelshark				1	1	1	1	2	3	3
<i>Heterodontus portusjacksoni</i>	Port Jackson Shark					3		1	2	3	3
Batoids	Unidentified rays			1	1	1			3	3	3
<i>Myliobatis australis</i>	Southern Eagle Ray	3		10	8	8		21	8	29	27
<i>Trygonorrhina</i> sp.	Fiddler Ray					1		1		1	1
<i>Dasyatis thetidis</i>	Black Stingray			1				1		1	1
<i>Caretta caretta</i>	Loggerhead Turtle	1							1	1	1
<i>Cheloniidae</i>	Turtle					1			1	1	1
<i>Megaptera novaeangliae</i>	Humpback Whale	1				1		2		2	2
	TOTAL	12	2	29	20	30	15	34	73	108	

*The percentage (%) has been rounded to nearest whole number, and therefore rounding up of the total percentage may equate to a number in excess of 100%

Table 7: Non-target and threatened species entanglements for 2002-03 to 2012-13 and trigger point analysis for 2012-13.

Scientific Name	Common Name	02 - 03	03 - 04	04 - 05	05 - 06	06 - 07	07 - 08	08 - 09	09 - 10	10 - 11	11 - 12	10 yr annual average	Trig. pt. (2 x 10 yr ann. avg.)	11 - 12	12 - 13	Trigger point trip?
Threatened Species																
<i>Carcharodon carcharias</i>	White Shark	6	5	10	8	11	7	8	5	6	15	8.1	16.2	15	3	No
<i>Carcharias taurus</i>	Grey nurse Shark	3	1	2	1	2	2	1	2	3	4	2.1	4.2	4	9	No
<i>Sphyrna lewini</i>	Scalloped H'head ²	12	0	0	0	0	0	1	0	0	0	1.3	2.6	0	1	No
<i>Cheloniidae sp.</i>	Turtles ³	1	2	4	5	2	3	3	2	6	2	3.1	6.2	2	2	No
<i>Megaptera novaeangliae</i>	Humpback Whale	0	0	0	1	0	0	0	0	0	0	0.1	0.2	0	2	No
Non-Target Species																
<i>Sphyrna sp.</i>	Hammerhead Sharks ²	74	39	57	40	34	18	13	16	18	36	34.5	69	36	22	No
<i>Squatina australis</i>	Australian Angelshark	12	14	15	15	10	15	13	12	19	14	13.9	27.8	14	3	No
<i>Heterodontus sp.</i>	Port Jackson Shark	9	5	7	2	4	2	2	6	0	4	4.1	8.2	4	3	No
<i>Batoids</i>	Rays and skates	26	27	58	60	51	46	30	44	56	42	44.4	88.8	42	34	No

¹ Includes mortalities and animals released alive.

² There are low levels of confidence in hammerhead species identification in historical data.

³ Turtles have been grouped at family level for reporting purposes. There are low levels of confidence in turtle species identification in historical data. One Loggerhead Turtle and one unidentified Turtle were caught in the 2012-13 season. All unidentified Turtles have been assumed to be threatened species

1.2.4 Extent to which the reporting requirements are met.

Trigger points and responses:

1. Monthly catch summary reports to be provided to OEH, the Scientific Committee and the Fisheries Scientific Committee.

DPI provided monthly catch summary reports to OEH (Department of Premier and Cabinet), the Scientific Committee and the Fisheries Scientific Committee, during the 2012-13 shark meshing season. The last monthly report was provided on 24 July 2013 after the conclusion of the meshing season. Final proofed summaries of the monthly catch summary reports for the 2012-13 meshing season are attached in Appendix 1. Note that each report is for a 4 week period (rather than a full calendar month) in line with current contractor reporting and net checking arrangements.

2. Annual performance report submitted to the Minister for Primary Industries, Director-General of NSW DPI, Director-General of Department of Premier and Cabinet, the Scientific Committee and the Fisheries Scientific Committee by 31 July each year.

In accordance with the requirements of the JMAs this report was provided to the Director General of DPI, the Department of Premier and Cabinet and to the Minister for Primary Industries by 31 July. The NSW Scientific Committee and the Fisheries Scientific Committee were also provided with copies and their responses are attached as Appendix 2 and 3. This version of December 2013 is a corrected and proofed version to be made publicly available on the NSW DPI website.

2 Other Programs Complementing the SMP

2.1 The SharkSmart Public Awareness and Education Program

In September 2009, following a recommendation from the SMP report and submissions from the community, the public education and awareness campaign 'SharkSmart' was launched to reduce the risk of a close encounter with a shark. SharkSmart is the State's first ever education campaign designed to inform the public, through web and print, of how they can reduce their risk of a close encounter with a shark.

A website page was developed to establish a 24-hour platform for delivery of the information and a SharkSmart brochure (Appendix 4) was produced. The brochure is an informative guide to some common sense measures to increase safety in the water. The brochure includes a check list including such information as avoiding the water when sharks are most active (at dusk and dawn), not swimming or surfing near schools of baitfish, and avoiding murky water.

DPI maintained the SharkSmart education program during the reporting period to reinforce the risks associated with sharks through with a continued presence on the internet (<http://www.dpi.nsw.gov.au/fisheries/info/sharksmart>) and through print media.

From 1 September 2012 to 30 April 2013 the DPI web page (www.dpi.nsw.gov.au) displayed links to the SharkSmart material through a web page mechanism known as 'spotlighting' where links to highly topical information are presented at the first point of entry to the page making access to the information easy to find. Other web page enhancements were undertaken including the establishment of more prominent links to allow users to download an electronic version of the printed SharkSmart brochure or submit requests for bulk quantities of the brochure for redistribution.

Several opportunities were taken during the reporting period to highlight the SharkSmart program's key messages in media releases associated with shark related issues. The SharkSmart logo was submitted to IP Australia and accepted for registration as a trademark in Australia in July 2012.

2.2 Aerial Surveillance

As per previous years, a series of aerial surveys were flown along the coast over the SMP region from Stockton to Wollongong. Flights were extended northwards up to Seal Rocks to include the White Shark nursery grounds in NSW. The northern section was flown to link with White Shark surveys flown by UTS and CSIRO scientists. Due to the previous years' consistently higher counts by observers in rotary wing aircraft, all surveys were flown by helicopter.

Newcastle Helicopters Pty Ltd were contracted through an open tender process to conduct a flight on one day each week, plus over each weekend and public holiday during the high use holiday period. The trial in 2012-13 was planned for 21 days (42 passes over each beach) — each weekend and public holiday over the peak summer holiday period and every Wednesday from 19 December 2012 to 27 January 2013.

The aircraft were required to have an observer on board who was able to take high resolution digital photographs. The specified duties of the aerial surveillance observer were to:

- Look for sharks in the water and shoals of bait fish, and where possible, accurately identify the species of shark from the air.
- Provide accurate GPS location of each sighting, plus the estimated distance and angle from the aircraft.
- Record weather and environmental conditions for each flight, including recording the positions where these may have changed.
- Provide timely and adequate records of sightings to DPI, SLS NSW and the Australian Professional Ocean Lifeguards Association (APOLA).
- Report all sightings by mobile phone to the relevant surf lifesaving groups (SLS NSW and APOLA) and DPI contact person.
- Capture high quality air photographs (images) of every shark and bait fish shoal using a high resolution digital SLR camera (e.g. minimum 12 Mega Pixel with 200 mm zoom lens) with an attached GPS recorder. Metadata for each image was recorded including the date taken.

Two of the planned flight days and one return flight from Wollongong were cancelled either due to inclement weather, aircraft problems, or lack of personnel (Christmas and Boxing Day) meaning 5 of the planned 42 passes were not completed. This resulted in a total of 37 passes over the SMP region and 38 passes from Stockton north to Seal Rocks.

A maximum of 100 animal sightings were recorded during 37 flight passes over the SMP region (Stockton to Wollongong), with twice the number of animals being recorded during south-bound flights, 47% of which were schools of fish. Only 25 sharks were sighted of which 20 were hammerhead sharks, a non-target species in the SMP.

These results again highlighted the low sighting rates from aircraft, with less than 1 shark seen per 100 km flown, implying a considerable underestimation of the presence of many of the shark species known to frequent the coastal fringe area. These data corroborate previous survey results

suggesting aerial surveys are an inefficient and expensive method to enhance bather protection from potential shark attack.

The second component of the 2012-13 aerial surveys involved 38 flight passes between Stockton and Seal Rocks. These flights were designed to assess the difference in White Shark abundance between the SMP region and their known nursery grounds in Stockton Bight. These data complement results from aerial surveys being conducted by the CSIRO White Shark researchers.

A total of 194 sightings were made during these northern aerial surveys in almost equal proportion between north-bound and south-bound flights. A total of 102 sharks were sighted, the majority of which were juvenile White Sharks. The discrepancy in White Shark sightings between these northern flights and the SMP region highlights the status of this area being considered the nursery grounds for the Australian east coast population of White Sharks.

Any sharks seen that may have posed a danger to swimmers or caused alarm were reported directly to appropriate surf life saving bodies to ensure that swimmers could be notified almost instantly of any increased risk or concern. No beaches were closed during the trial however on various occasions SLS NSW launched a rigid hull inflatable vessel to determine the location of the shark and to assess ongoing risk. On each occasion the shark quickly moved into deeper water and bathers subsequently returned to the water.

One shark bite occurred within the region covered by the aerial surveys. The incident occurred at Dee Why on 30 December 2012 at 11:45 am. The victim was surfing along a wave when he felt a bump on his surfboard. The surfer did not see anything, but on reaching the beach after riding a few more waves noticed a crescent-shaped 'bite' in the lower deck of his surfboard. The aerial survey aircraft flew over this beach at 12:15 pm southbound within 30 minutes of the interaction. No animal sightings were recorded within a 33 km radius of Dee Why.

These data again imply the ineffective nature of aerial surveys in providing an additional bather safety network against potential shark attack. The results of the various studies undertaken over several years to date raise serious concerns about the utility of aerial beach patrols as an early warning system for sharks.

3 Other issues

3.1 Listing of new threatened species

No new species impacted by the SMP were listed as threatened during the 2012-13 meshing season. The Fisheries Scientific Committee publicly exhibited a proposed determination to list the Smooth Hammerhead shark as a Vulnerable species from 15 August 2012 to 29 September 2012. However, at the time of preparing this report Smooth Hammerhead shark was not listed as a threatened species.

4 Changes to the Management Plan

4.1 Recommended amendments

In accordance with cl.47(1)c), no amendments to the Management Plan are recommended as a result of the performance of the SMP for the 2012-13 meshing season.

4.2 Adoption of amendments from the 2011-12 Annual Performance Report

The 2011-12 Annual Performance Report recommended several amendments be made to the Management Plan. Following notification to the Department of Premier and Cabinet and the Minister for Primary Industries and pursuant to cl.52 of the Management Plan, the following amendments have been made:

1. Nature of the proposed change:
 - All references to the Department of Environment, Climate Change and Water in the Management Plan have been changed to the Department of Premier and Cabinet.
 - All references to the Department of Industry and Investment in the Management Plan have been changed to the Department of Primary Industries.
 - Clause 20 of the Management Plan has been amended to include the Sydney Central region.
 - All relevant clauses and tables in the Management Plan have been amended to rename the Newcastle region the Hunter region.

2. Reason why the proposed changes were required:
 - To maintain the currency and accuracy of the Management Plan.

3. Effect of making the proposed change:
 - The Management Plan has been revised and all relevant references changed. The changes have not affected total effort of meshing operations in any way, and do not change the individual beaches that are meshed within the program.

References

- Blower, D.C., J.M. Pandolfi, B.D. Bruce, M del C. Gomez-Cabrera and J.R. Ovenden. 2012. Population genetics of Australian white sharks reveals fine-scale spatial structure, transoceanic dispersal events and low effective population sizes. *Marine Ecology Progress Series* 455: 229-244.
- Boomer, J.J., V.M. Peddemors and A.J. Stow. 2010 Genetic data show that *Carcharhius tilstoni* is not confined to the tropics, highlighting the importance of a multifaceted approach to species identification. *Journal of Fish Biology* 77: 1165-1172.
- Department of Environment, Climate Change and Water, 2009. *New South Wales State of the Environment 2009*. Sydney, NSW.
- Green, M., Ganassin, C. and Reid, D.D., 2009. Report into the NSW Shark Meshing (Bather Protection) Program. Fisheries Conservation and Aquaculture Branch. Orange NSW.
- Huveneers C., P.J. Rogers, J.M. Semmens, C. Beckmann, A.A. Kock, B. Page and S.D. Goldsworthy. 2013 Effects of an Electric Field on White Sharks: In Situ Testing of an Electric Deterrent. *PLoS ONE* 8(5): e62730. doi:10.1371/journal.pone.0062730
- Peddemors, V.M., 2007. Final Report on the feasibility of using shark deterrent devices to replace shark nets off New South Wales. Unpublished Report to NSW DPI. 13pp.
- Reid D.D., W.D. Robbins, V. M. Peddemors. 2011 Decadal trends in shark catches and effort from the New South Wales, Australia, Shark Meshing Program 1950-2010. *Marine and Freshwater Research* 62: 676-693

Bibliography

- Benavides, M.T., R.L. Horn, K.A. Feldheim, M.S. Shivji, S.C. Clarke, S. Wintner, L. Natanson, M. Braccini, J.J. Boomer, S.J.B. Gulak and D.D. Chapman. 2011 Global phylogeography of the dusky shark *Carcharhinus obscurus*: implications for fisheries management and monitoring the shark fin trade. *Endangered Species Research* 14:13-22.
- Macbeth W.G., M. Vandenberg, K.J. Graham. 2008 Identifying Sharks and Rays – A guide for NSW commercial fishers. NSW Department of Primary Industries.

Appendix 1 – Monthly catch summaries for the 2012-13 meshing season

Appendix Table 1: Detailed Catch Report - 1 September 2012 to 28 September 2012

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Merewether	10/09/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	?	?
	Dixon Park	16/09/12	<i>Megaptera novaeangliae</i>	Humpback Whale	Alive	~12	?
Central Coast	Nil catch						
Sydney North	Whale	17/09/12	<i>Carcharias taurus</i>	Greynurse Shark	Alive	2.5	F
	Avalon	24/09/12	<i>Dasyatis thetidis</i>	Black Ray	Alive	1.2	?
Sydney Central	Harbord	21/09/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	4.5	F
Sydney South	Wattamolla	24/09/12	<i>Sphyrna lewini</i>	Scalloped Hammerhead	Dead	1.9	F
	Cronulla	24/09/12	<i>Heterodontus portusjacksoni</i>	Port Jackson Shark	Alive	1.1	F
Illawarra	Coledale	06/09/12	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	2.3	M
	Coledale	10/09/12	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	3.2	F

Appendix Table 2: Detailed Catch Report - 29 September 2012 to 26 October 2012

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Merewether	17/10/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	?	?
Central Coast	Nil Catch						
Sydney North	Nil Catch						
Sydney Central	Dee Why	18/10/12	<i>Squatina australis</i>	Australian Angelshark	Alive	0.76	F
Sydney South	Wanda	06/10/12	<i>Megaptera novaeangliae</i>	Humpback Whale	Alive	?	?
	Coogee	24/10/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	1	F
Illawarra	Coledale	12/10/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	?	?
	Austinmer	19/10/12	<i>Carcharias taurus</i>	Greynurse Shark	Alive	2.5	F

Abbreviations

? Not recorded/unknown
 ~ Approximately
 FL Fork Length

Appendix Table 3: Detailed Catch Report - 27 October 2012 to 23 November 2012

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Swansea-Blacksmiths	14/11/12	<i>Carcharodon carcharius</i>	White Shark	Dead	2.7	F
	Swansea-Blacksmiths	14/11/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.51	F
Central Coast	Lakes	12/11/12	<i>Carcharhinus sp.</i>	Whaler Shark	Dead	2.7	F
Sydney North	Palm	30/10/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	0.9	M
	Bilgola	5/11/12	<i>Myliobatiformes sp.</i>	Ray	Alive	1.2	M
	Palm	6/11/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.1	M
Sydney Central	Curl Curl	31/10/12	<i>Carcharhinus brevipinna</i>	Spinner Shark	Dead	2.3	?
	North Narrabeen	12/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.7	F
	North Narrabeen	12/11/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.48	F
	Narrabeen	12/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.8	F
	Harbord	12/11/12	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	2.44	M
Sydney South	Bondi	15/11/12	<i>Carcharodon carcharias</i>	White shark	Dead	2.2	F
	Bondi	15/11/12	<i>Carcharias taurus</i>	Greynurse Shark	Dead	2.6	M
	Coogee	15/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.6	F
	Bondi	15/11/12	<i>Carcharias taurus</i>	Greynurse Shark	Dead	2.9	F
	Coogee	19/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	1.1	F
Illawarra	Thirroul	19/11/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.2	M

Abbreviations

? Not recorded/unknown
~ Approximately
FL Fork Length

Appendix Table 4: Detailed Catch Report - 24 November 2012 to 21 December 2012 – NSW Shark Meshing (Bather Protection) Program

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Caves Beach	18/12/12	<i>Carcharias taurus</i>	Greynurse Shark	Dead	2.8	F
	Stockton	27/11/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.16	M
Central Coast	Nil Catch						
Sydney North	Avalon	30/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	?	?
	Whale	26/11/12	<i>Galeocerdo cuvier</i>	Tiger Shark	Alive	3.5	F
	Whale	12/12/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	?	?
Sydney Central	North Steyne	18/12/12	<i>Myliobatiformes sp.</i>	Ray	Alive	1.3	F
Sydney South	Bronte	30/11/12	<i>Carcharias taurus</i>	Greynurse Shark	Dead	2.47	F
	Bondi	18/12/12	<i>Trygonorrhina sp.</i>	Eastern Fiddler Ray	Alive	1.1	F
	Coogee	21/12/12	<i>Heterodontus portusjacksoni</i>	Port Jackson Shark	Dead	1.15	F
	Coogee	30/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	1.9	F
	Coogee	30/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.6	?
	Coogee	30/11/12	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	3.0	M
	Coogee	30/11/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	0.9	F
	Garie	29/11/12	<i>Myliobatiformes sp.</i>	Ray	Alive	0.5	M
	Maroubra	18/12/12	<i>Carcharias taurus</i>	Greynurse Shark	Alive	3.0	F
Wattamolla	28/11/12	<i>Carcharias taurus</i>	Greynurse Shark	Dead	2.1	F	
Illawarra	Nil Catch						

Abbreviations

? Not recorded/unknown
~ Approximately
FL Fork Length

Appendix Table 5: Detailed Catch Report - 22 December 2012 to 18 January 2013

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Catherine Hill Bay	16/1/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.21	M
Central Coast	Terrigal Beach	22/12/12	<i>Carcharias taurus</i>	Greynurse Shark	Dead	2.02	M
Sydney North	Whale	28/12/12	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	1	?
	Avalon	27/12/12	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	3.05	F
	Palm	24/12/12	<i>Isurus sp.</i>	Mako Shark	Dead	1	F
Sydney Central	Narrabeen	28/12/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.3	
Sydney South	Nil Catch						
Illawarra	South Wollongong	27/12/12	<i>Galeocerdo cuvier</i>	Tiger Shark	Alive	2.14	M
	South Wollongong	27/12/12	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.5	M
	Coledale	7/1/13	<i>Squatina australis</i>	Australian Angelshark	Dead	0.62	F
	Coledale	7/1/13	<i>Carcharodon carcharias</i>	White Shark	Dead	1.7	M

Appendix Table 6: Detailed Catch Report - 19 January 2013 to 15 February 2013

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Stockton	8/2/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	?	?
Central Coast	Nil Catch						
Sydney North	Whale	18/1/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	1	F
	Whale	18/1/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	1	M
Sydney Central	Harbord	13/2/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.65	F
	North Steyne	5/2/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	0.8	F
	North Steyne	5/2/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.8	F
	Dee Why	1/2/13	<i>Carcharhinus leucas</i>	Bull Shark	Dead	3.2	F
Sydney South	Garie	12/2/13	<i>Isurus sp.</i>	Mako	Dead	0.74	F
	Wattamolla	6/2/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	1.6	M
	Garie	6/2/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.37	F
	Wattamolla	6/2/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	?	F
	Wattamolla	6/2/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead/decomposed	?	M
Illawarra	Austinmer	30/1/13	<i>Carcharhinus brachyurus</i>	Bronze Whaler Shark	Dead	2.2	M
	North Wollongong	30/1/13	<i>Carcharhinus brachyurus</i>	Bronze Whaler Shark	Dead	2.1	M

Abbreviations

? Not recorded/unknown
 ~ Approximately
 FL Fork Length

Appendix Table 7: Detailed Catch Report - 16 February 2013 to 15 March 2013

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Newcastle	6/3/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.01	M
	Swansea-Blacksmiths	6/3/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.21	F
Central Coast	Nil Catch						
Sydney North	Mona Vale	7/3/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	2.2	M
	Mona Vale	7/3/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	2.0	M
	Mona Vale	9/3/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	?	?
	Mona Vale	9/3/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	?	?
	Bilgola	5/3/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	0.8	?
	Bilgola	9/3/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	?	?
	Bilgola	26/2/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	0.8	?
Sydney Central	North Narrabeen	9/3/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.4	F
	Dee Why	9/3/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.85	F
	Manly	5/3/13	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	3.2	F
	Harbord	25/2/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Alive	1.3	M
Sydney South	Wattamolla	19/2/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	?	M
	Wattamolla	5/3/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Alive	?	?
Illawarra	North Wollongong	5/3/13	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	0.69	M

Abbreviations

? Not recorded/unknown
 ~ Approximately
 FL Fork Length

Appendix Table 8: Detailed Catch Report: 16 March 2013 to 12 April 2013

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Nil Catch						
Central Coast	Nil Catch						
Sydney North	Newport	22/3/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1	F
	Palm	8/4/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	0.93	F
	Palm	12/4/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.27	M
	Bilgola	12/4/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	1.31	M
	Warriewood	12/4/13	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	1.07	M
Sydney Central	Harbord	23/3/13	<i>Carcharhinus falciformis</i>	Silky Shark	Dead	0.89	M
Sydney South	Garie	19/3/13	<i>Cheloniidae sp.</i>	Turtle	Dead	0.5	?
	Bronte	5/4/13	<i>Heterodontus portusjacksoni</i>	Port Jackson Shark	Dead	0.9	M
Illawarra	Thirroul	18/3/13	<i>Sphyrna sp.</i>	Hammerhead Sharks	Dead	1.24	F
	South Wollongong	18/3/13	<i>Sphyrna sp.</i>	Hammerhead Sharks	Dead	1.18	?
	South Wollongong	18/3/13	<i>Sphyrna sp.</i>	Hammerhead Sharks	Dead	1.33	?

Appendix Table 9: Detailed Catch Report: 13 April 2013 to 30 April 2013

Region	Beach	Date	Scientific Name	Common Name	Dead/Alive	Size (m) (FL)	Sex
Hunter	Newcastle	28/4/13	<i>Caretta caretta</i>	Loggerhead Turtle	Dead	?	?
Central Coast	Nil Catch						
Sydney North	Avalon	23/4/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.3	?
	Newport	23/4/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	1.1	?
	Newport	22/4/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	1.98	M
	Palm	17/4/13	<i>Carcharhinus limbatus</i>	Common Blacktip Shark	Dead	2.21	F
Sydney Central	North Steyne	15/4/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	0.99	M
	Narrabeen	15/4/13	<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	Dead	0.96	F
Sydney South	Wanda	25/4/13	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive	0.85	M
	Cronulla	25/4/13	<i>Squatina australis</i>	Australian Angelshark	Dead	0.9	F
Illawarra	Nil Catch						

Abbreviations

? Not recorded/unknown
~ Approximately
FL Fork Length

Appendix 2 – Letter from the NSW Fisheries Scientific Committee

The Hon Katrina Hodgkinson MP
Minister for Primary Industries
Level 30
Governor Macquarie Tower
1 Farrer Place
SYDNEY NSW 2000



Dear Minister

Re: Annual Performance Report for the Shark Meshing (Bather Protection) Program

The NSW Shark Meshing (Bather Protection) Program (SMP) operates under two Joint Management Agreements (JMAs) and a management plan, which provides for improved environmental outcomes and is required by legislation under the *Fisheries Management Act 1994* and *Threatened Species Act 1995*.

As required by Section 221Y of the *Fisheries Management Act 1994*, the Fisheries Scientific Committee's (FSC) role regarding the JMA is to:

- (1) conduct a review of the performance of all parties to the joint management agreement, and
- (2) advise the Minister of any deficiencies in implementation of the joint management agreement by any party to it.

The FSC has reviewed the performance of all parties as outlined in the SMP 2012-13 Annual Performance Report. Although operational aspects of the SMP were largely fulfilled, the FSC has significant concerns in relation to the scientific and research aspects of the SMP.

The Annual Performance Report includes the statement that "The SMP has been effective at providing a safer environment for swimmers". As the Committee has done in its review letters in previous years, it reiterates that this statement is unsubstantiated because it is not based on a scientific comparison between meshed and unmeshed beaches of shark numbers, interactions or attacks. This is the same criticism that the FSC had in the 2009-10, 2010-11 and 2011-12 assessments of the SMP, but which again has not been corrected in the 2012-13 report. The FSC requests the SMP to remove this statement from the 2012-13 Annual Performance Report.

The FSC urges the SMP to focus in 2013-14 on the components of the Strategic Research and Monitoring Program that would assist in the scientific evaluation of the SMP. This will allow the SMP to be properly assessed when the Joint Management Agreements are reviewed in 2014. The relevant available information should be gathered/presented in such a manner that the situation on unmeshed beaches that are or are not in the vicinity of meshed beaches can be evaluated. An assessment of the program is important because it is listed as a Key Threatening Process for several species of sharks. If the program is not effective at providing a safer environment for swimmers in meshed beaches than unmeshed beaches or reduces safety at unmeshed beaches near to meshed beaches, then there may be a need for modification or discontinuation of the SMP.

The FSC considers that several of the projects listed in the Strategic Research and Monitoring Program are crucial to our understanding of the impact of the SMP on both individual shark species and NSW shark stocks. The FSC particularly welcomes the project on fisheries' interactions with Smooth Hammerhead Sharks and research on the movement of sharks (Objective 2.3, "Review data on temporal and spatial factors affecting the operation of the SMP" p. 19). The FSC supports projects such as the acoustic tagging of bull sharks (project 2.3.2). These are very important for understanding shark movements given that the results of the aerial survey project show this technique to be ineffective at sighting sharks.

The Committee notes that large numbers of Grey Nurse Sharks (eight being four times the 10 year average) and Humpback Whales (two, compared to a 10 year annual average of 0.1) were caught in 2012-13. If more than five Grey Nurse Sharks or one Humpback Whale are caught in 2013-14 a species-specific trigger point will be tripped. Given that this scenario is quite possible, the Committee would like to know how the Department proposes to address this situation should it eventuate.

The committee notes that the performance indicator for human safety was triggered in 2011-12 by a serious injury resulting from shark attack at Redhead Beach. The FSC has not yet received the report reviewing this incident under section 48 (5) of the Management Plan for the NSW Shark Meshing (Bather Protection) Program.

The Committee notes that the observer program was somewhat curtailed in 2012-13 as funding was re-directed to aerial surveillance research surveys and the “beach observation tower” program. The FSC is concerned that without substantial government financial support for the Strategic Research and Monitoring Program in the SMP, we will again be faced with an inability to assess the impact of the SMP scientifically, as per the requirements of the JMA and Management Plan. The FSC therefore urges the government to allocate a suitable budget to the science and research component of the SMP to ensure all JMA and Management Plan requirements are met.

The FSC welcomes the trial in the Sydney Central Region in 2012-13 of the practice of setting nets at a depth of approximately one metre off the bottom. The committee recommended this practice in its letter to you reviewing the 2011-12 Annual Performance Report, as a means to minimise or eliminate bycatch of rays and benthic non-target shark species, such as angel sharks. The FSC agrees that too few data are yet available for testing the statistical significance of the initiative. The Committee is pleased to note, however, that all but one of the entangled rays was released alive.

The FSC notes the substantial decline over recent years in catch numbers in the Central Coast in comparison to other regions. Indeed only one animal (a whaler shark) was caught at any beach in this region in the 2012-13 meshing season. The FSC considers that this is worthy of further investigation to determine whether this decline provides lessons that can also be applied in other regions.

The FSC would like to see a tabulation of the data that allows comparisons of catch (by species) during days when observers were present and days when they were not.

In summary, the Committee would like specific reporting and analyses on the following key issues:

- A rigorous scientific comparison of data within each management zone on shark sightings, shark attacks and beach usage rates between meshed and unmeshed beaches.
- At the individual shark level, more understanding of shark movements around nets and the beaches of NSW. Such data would provide crucial information in the assessment of public safety and the efficacy of nets in preventing shark attacks
- Whether the mortality rate is related to set time. The Committee would like to know whether mortality is higher in nets set more than the prescribed 72 hour soak time and, if there are any available data on whether mortality is lower for shorter soak times of 24 hours or 48 hours.

Yours sincerely



Dr Don Colgan and Mr Mark Lintermans
Current members (in the absence of an appointed Chairperson)
Fisheries Scientific Committee
5 September 2013

Appendix 3 – Letter from the NSW Scientific Committee

NSW SCIENTIFIC COMMITTEE

Mr Chris Eccles
Director General
Department of Premier and Cabinet
GPO Box 5341
SYDNEY NSW 2001

Dear Mr Eccles,

As you will be aware, under the *Threatened Species Conservation Act 1995* (TSC Act), the Scientific Committee is required to conduct an annual review of the performance of all parties to Joint Management Agreements and provide comments to the Director General of the Department of Premier and Cabinet.

The Scientific Committee has reviewed the Shark Meshing (Bather Protection) Program 2012-13 Annual Performance Report. With mortalities of protected species again reported, the Committee maintains its concern for the impact the SMP has on protected and threatened marine species in NSW.

The Committee notes the unfortunate incident of humpback whales becoming entangled in nets on two separate occasions. As reported, these incidents occurred in the Hunter Region on September 16 and Sydney South Region on October 6. Elsewhere in the report it states that on one occasion during September/October, nets remained set for a period of one week, as inclement weather prevented nets being checked at the usual 72 hour interval. No further information is provided in the report as to whether this occurred at Dixon Park Beach (Hunter Region) or Wanda Beach (Sydney South region), but it would be valuable to know whether entanglement and/or mortality occurred when nets were set for longer than anticipated. The Committee would welcome detail of this kind being included in future reports.

The Committee notes that in Table 9 of the report, the two humpback whales referred to above are classified as being 'released alive', however we suggest a new category of 'Fate Unknown' would more accurately describe such outcomes. It must be assumed that a whale carrying a relatively large quantity of net will have significantly compromised survival.

As stated by this Committee previously, trigger points should be sensitive to the population parameters of particular species. However, as they are currently set, trigger points are too coarse to initiate an effective change in management for species with declining or recovering populations. In addition, trigger points currently take no account of the different threat categories in which a species is listed. More sensitive

trigger points should be set for species listed as Endangered or Critically Endangered, where life history traits (e.g. late maturation, low fecundity, small population size) and low population numbers already predispose species to significant impacts from anthropogenic sources of mortality. The Committee therefore once again urges a review of the scientific basis for setting trigger points, taking into account population size, demographic structure, breeding biology and the cumulative effect of other anthropogenic sources of mortality affecting each non-target and threatened species that interacts with the SMP.

Finally, while the Committee understands its statutory responsibilities pertain to marine mammals and reptiles (as listed under the *Threatened Species Conservation Act 1995*), we remain concerned about the impacts of the shark meshing program on species listed under the *Fisheries Management Act 1994*, in particular the Endangered grey nurse shark (*Carcharias taurus*). The Committee will continue to raise its concern regarding the SMP until it is satisfied that all efforts are being made to improve the operation of the Program in relation to mitigating impacts on non-target marine species.

This letter is provided in accordance with section 122 of the TSC Act. A similar letter has been forwarded to Ms Sally Barnes, Chief Executive, Office of Environment and Heritage for her information.

Yours sincerely



Associate Professor Michelle Leishman
Chairperson
Scientific Committee

Ltr Sharkmeshing Ann rot 2013.doc

ESTABLISHED UNDER THE THREATENED SPECIES CONSERVATION ACT 1995

Contact Address: C/o PO Box 1967 Hurstville BC NSW 1481 Telephone: (02) 9585 6940 Facsimile: (02) 9585 6606

Appendix 4 – SharkSmart awareness and education program brochure

SHARKSMART

Industry & Investment
NSW GOVERNMENT

Sharks live in healthy oceans

Sharks are a natural part of healthy oceanic and estuarine environments. When people enter open water, they are entering the shark's domain.

Shark attacks are rare events. Millions of us swim in oceans, harbours, coastal rivers and lakes each year, with just a handful of attacks. The only way to completely rule out a close encounter with a shark is to swim in a pool or other enclosure, or to stay on the shore!

However, a better awareness and understanding of sharks and their behaviour can help everyone to safely enjoy water sports, particularly younger people and tourists, as well as surfers and divers who choose to swim outside patrolled areas.

Shark meshing in NSW

The Shark Meshing (Bather Protection) Program helps provide a safer environment for swimmers and surfers and has proven effective in greatly reducing the number of shark attacks.

The program sees specially designed nets placed along 51 high-use beaches from Newcastle to Wollongong from 1 September to 30 April. The nets deter sharks from establishing territories—reducing the odds of an encounter. They are not meant to form a physical barrier.

There has only been one fatal attack on a netted beach since 1937 but there are no 100% guarantees against a shark attack.

While committed to the program, the NSW Government is conscious of the potential impact nets have on other marine life. Specialist contractors free any non-target sharks or other marine life caught where it is practical and safe to do so. Nets are not set during the majority of the whale migration season. When nets are set, special sound devices are used to deter dolphins and whales.

Safety tips for swimmers, surfers, divers, snorkelers and spearfishers

Know the risks and reduce your chances of a close encounter with a shark at NSW beaches and estuaries

www.dpi.nsw.gov.au/info/sharksmart

AUSTRALIAN LIFEGUARD SERVICE

APOLA

SHARKSMART

www.dpi.nsw.gov.au/info/sharksmart

18/NSW_9599_SEPT09

Appendix 4 - continued



SharkSmart swimmers and surfers



- Swim at a patrolled beach, between the flags—lifesavers and lifeguards are there to monitor risks and maximise swimmer safety
- Tell an on-duty lifesaver or lifeguard if a shark is spotted near swimmers or surfers
- Leave the water if a shark is spotted or alarm is sounded
- Don't swim too far from shore
- Swim in groups
- Avoid surfing alone
- Avoid swimming and surfing when it's dark or during twilight hours
- Avoid murky water and waters with known effluents or sewage
- Avoid areas used by recreational or commercial fishers
- Do not swim/surf near or interfere with shark nets
- Avoid areas with signs of baitfish or fish feeding activity—watch for diving seabirds
- Do not rely on dolphins to indicate the absence of sharks—they often feed together
- Avoid having pets in the water with you
- Be aware that sharks may be present between sandbars or near steep drop offs
- Avoid swimming in canals, and swimming or surfing in river/harbour mouths

SharkSmart divers, snorkelers and spearfishers

- Find out about the kinds of sharks you might encounter and what behaviour to expect from them
- Realise diver safety becomes increasingly difficult with decreasing visibility at night or in turbid water, and with increasing depth and current
- Discuss dive logistics and contingency plans such as hand signals, entry and exit considerations and separation procedures with your dive partner before you enter the water
- Be aware that using bait to lure fish may attract sharks
- Don't chase, grab, corner, spear or touch a shark
- Don't use bait or attempt to feed sharks—feeding may radically change behaviour and lure other sharks
- Be aware of the behaviour of fish—if they suddenly seek cover or appear agitated, leave the water as quickly and quietly as possible
- Don't attach a speared fish to your body or keep them near you—use a float and line to keep your catch away

