



Department of
Primary Industries

Shark Meshing (Bather Protection) Program

2010-11

Annual Performance Report

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

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Title:

Shark Meshing (Bather Protection) Program 2010-11 Annual Performance Report

ISSN 1839-0900

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Published by NSW Department of Primary Industries

This edition first published 2012

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Acknowledgements

The editors wish to acknowledge the following people for their valuable contribution; Surf Life Saving NSW, particularly, Dean Storey, John West (Curator of the Australian Shark Attack File) and staff from various branches of NSW Department of Primary Industries; Tony Andrews, Peter Gallagher, Will Robbins, Glenn Tritton, Patrick Tully, John Turpin, and Nick Otway.

Appreciation is also extended to other contributors who may not be listed above.

Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing. However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of Department of Primary Industries or the user's independent advisor.

TRIM reference: 10/4977 | PUB11/1

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Executive Summary

Since 2009-10 the Shark Meshing (Bather Protection) Program (SPM) has operated in accordance with Joint Management Agreements (JMAs) and an associated Management Plan. These documents specify that an annual report (this report) be prepared to report on the following key items:

- progress on implementing the objectives
- observer program
- compliance plan
- strategic research and monitoring program
- performance indicators (trigger points)
- any changes required

Implementation of the Management Plan's objectives is progressing on time or ahead of schedule. Contracts were revised so that in 2010-11 all contractors would operate in accordance with the provisions of the Management Plan (refer to section 1.1(a) Controls on activity).

On average observers were present during 46% of all net checks (hauls) undertaken by contractors and the 'Actual Hours' worked by all observers was within 2 percent of the total 'Allocated Hours' in the Management Plan (refer to section 1.1(b) Observer Program).

The compliance plan was implemented and there was nil non-compliance identified during the 2010-11 meshing period (refer to section 1.1(c) Compliance Plan).

A *Strategic Research and Monitoring Plan* document was completed to provide research directions, priorities and funding opportunities. Samples were collected as required to aid in scientific research and monitoring programs (refer to section 1.1(d) Strategic Research and Monitoring Program).

In 2010-11, no trigger points were tripped in relation to animals encountered in nets. However, the occupational health and safety trigger point was tripped, for the first time, because a minor injury (cut requiring suture) was reported by one of the contractors and a review report has been prepared (refer to section 1.2 Performance Indicators).

Other programs that are complementary to the SMP 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 an aerial surveillance trial that incorporated fixed wing aircraft and rotary wing aircraft to assess whether there is a role for aerial surveillance in bather protection (refer to section 2 Other Programs Complementing the SMP).

The only change recommended is to redefine what constitutes a minor injury (refer to section 3 Recommended Amendments).

In 2010-11 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 NSW most popular beaches each year. Under the program, 51 beaches are netted by contractors using specially designed meshing nets to reduce the chances of shark encounters. The SMP has been effective in helping to provide a safer environment for swimmers, with no fatalities on a meshed beach in over 50 years, and only one fatality since the program commenced.

In 2010-11, following the recommendations of a 2009 report into the environmental impacts of the program, the beach meshing contracts were revised so that the program would operate in accordance with Joint Management Agreements (JMAs) and an associated Management Plan under the *Fisheries Management Act 1994* and the *Threatened Species Conservation Act 1995*.

The Beach Meshing program is listed as a key threatening process by the Fisheries Scientific Committee as it adversely affects two or more threatened species, populations or ecological communities and could cause species, populations or ecological communities that are not threatened to become threatened. The JMAs and associated Management Plan was developed to minimise the impact of the program.

The Director General of Office of Environment and Heritage (OEH) - Department of Premier and Cabinet (formerly Department of Environment Climate Change and Water) may enter into a joint management agreement (JMA) under s. 121 of the *Threatened Species Conservation Act 1995* with another public authority. The purpose of a joint management agreement is to manage, regulate or restrict an action that is jeopardising the survival of a threatened species, population or ecological community.

For the SMP there are two Joint Management Agreements (JMAs). One is between the Minister for Primary Industries and the Department of Primary Industries (DPI). The second JMA is between DPI and OEH (formerly Department of Environment Climate Change and Water). The JMAs are publicly available from the department's website: <http://www.trade.nsw.gov.au>.

The JMAs and the associated Management Plan for the Shark Meshing (Bather Protection) Program (SMP) were developed after broad consultation with targeted specialist 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 a primary 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 species and other non-target species - and to maximise the potential scientific benefits of the SMP.

The objective of each JMA is to:

1. Minimise the impact of shark meshing on fish and marine vegetation which are 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 objective of each JMA:

1. DPI will only carry out shark meshing in accordance with the JMAs and the associated Management Plan.
2. DPI will only carry out shark meshing during the meshing season.
3. DPI will ensure that nets are fitted with acoustic warning devices.
4. DPI will require that contractors comply with by-catch reduction protocols and release protocols contained in the Management Plan and any release plans.
5. DPI will 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.
6. The parties to the JMAs will ensure that comprehensive release plans are in place.

The Management Plan objective is to:

1. Reduce the risk to humans from shark attack at beaches subject to the SMP, and, consistent with that objective:
 - a. 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.
 - b. Minimise occupational health and safety risks to contractors and agency personnel associated with implementing the SMP.
 - c. Ensure that monitoring and reporting on the SMP is undertaken in a transparent manner.

Activities of the SMP under the JMAs and Management Plan are defined as:

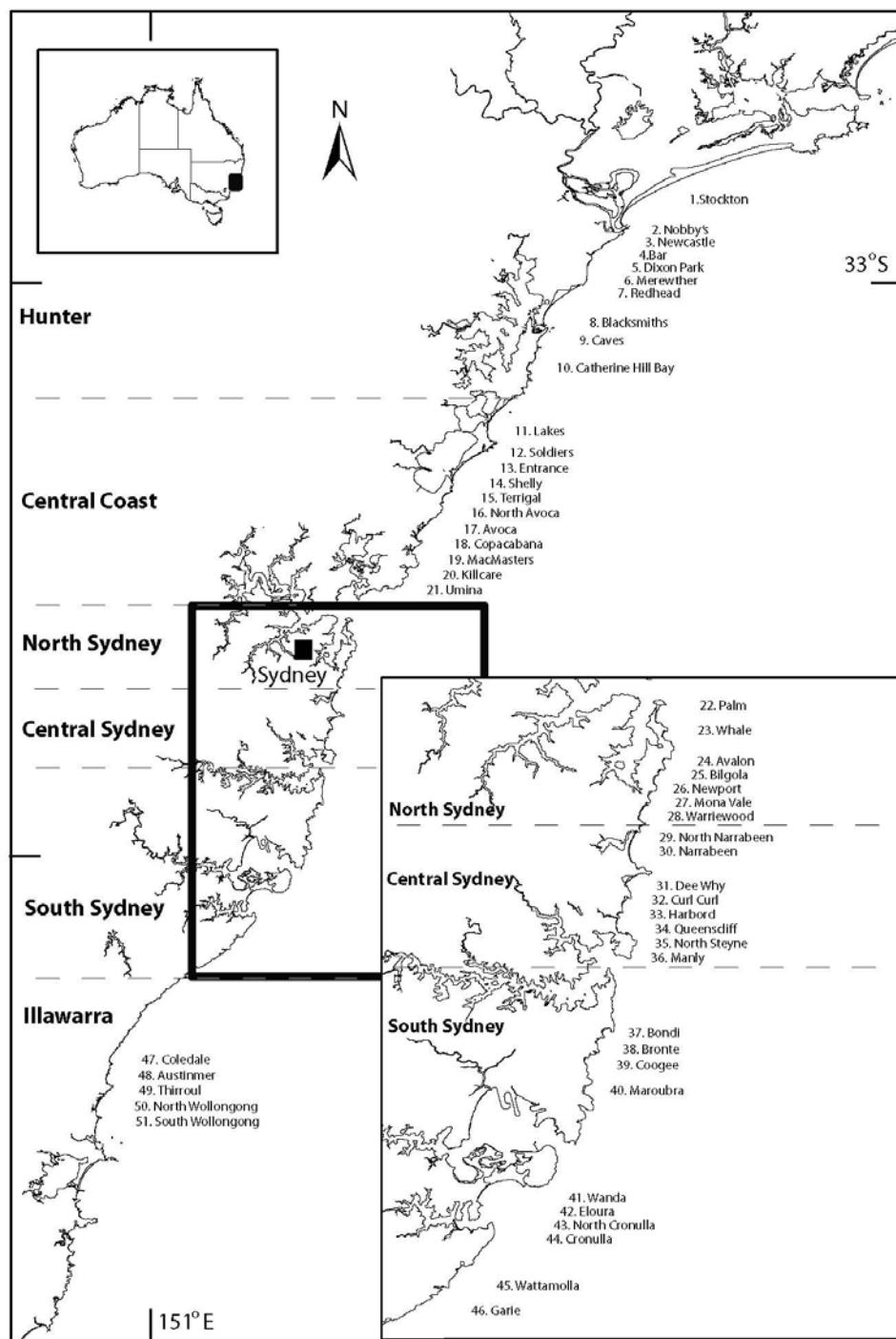
1. The placing of nets around beaches or other waters at the 51 beaches listed in Table 1 of the Management Plan to protect the public from sharks.
2. The activity is formally undertaken in NSW through the SMP.
3. The SMP uses bottom-set synthetic filament mesh nets 150m in length and 6m in depth of 60cm mesh size that are set in a generally parallel direction off the beach, anchored in approximately 10-12m depth of water. The nets have a weighted bottom line (leadline) and a floated top line (floatline) and are identified by surface floats.
4. The SMP includes all activities by contractors who set, haul, run, and clear the nets in accordance with requirements established by contract.
5. 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 2010-11 meshing period (1 September 2010 to 30 May 2011).

Table 1. The 6 regions and the 51 beaches of the SMP meshed during the 2010-11 meshing period.

Hunter Region	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 beaches included in the Shark Meshing (Bather Protection) Program.



1) Reporting on Achieving the Management Objectives:

In accordance with the legislative requirements relating to 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 will be made available publicly.

The Annual Performance Report is required to:

- a) Document progress in achieving management objectives by:
 - i) Reporting on progress in implementing the measures contained in the Management Plan,
 - ii) Assess and report on each performance indicator,
 - iii) Identify any trigger points that have been tripped, and
 - iv) Identify 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 (a) Controls on the activity (Part 3 of the Management Plan)

Part 3, Division 1 of the Management Plan (clauses 14 to 31) sets out the controls on the activity specifying the operational parameters of the program including: contract management, restrictions on waters, timing, gear and methods, and environmental protection provisions.

The Management Plan requires variation to the terms of existing contracts as soon as possible before 30 April 2012. A contract procurement process was completed in 2010 and implemented for 2010-11 period.

The Tender Specifications are consistent with the requirements as detailed in the JMA 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 (c) Compliance Plan).

1.1 (b) Observer Program (Part 4 of the Management Plan)

Establishment of the Observer Program

Part 4 of the Management Plan (clauses 32 to 36) establishes the Observer Program 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. Data and sample collection.
4. Detailing catch of target and non-target species.

Temporary employment

To satisfy the Observer Program requirements, five people were engaged in August 2010 by way of temporary employment for the eight months of the SMP (2010-11). Four of the positions were temporary-part time positions for 8 months of the SMP meshing period for 2010-11 and the fifth position (Sydney South) was retained as a temporary full-time position for the 8 months of the SMP meshing period. The latter position also helps the Shark Scientist with collation of data, dissections and cataloguing samples, purchasing and maintaining acoustic alarms and other duties associated with the SMP. One of the four temporary-part time positions (Newcastle) finalised his employment on 9 September 2010 leaving 4 observers to work with the 6 contractors. Due to the short notice of the observer's departure and the complexities in recruiting, training and equipping a temporary employee, some observers worked with more than one contractor. One observer worked with the Sydney Central and Sydney North contractors while another observer worked with Newcastle and Central Coast.

Duties of the Observers

Clause 35.1(a - e) of the Management Plan sets out the duties to be performed by observers, namely:

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 for the collection of sampled material for delivery to relevant end-point.
8. Observing and verifying (by initialing 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 ones that are not-operational, and date of battery replacement (including 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 enmeshed 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 2010-11 meshing period, the department conducted a Training Day in August 2010 at the Cronulla Fisheries Research Centre. Contractors also attended the training day and were instructed in tagging procedures. An OEH representative provided training to improve identification and management of captured marine mammals, birds and reptiles.

In 2011-12 contractors and observers will be advised to pay particular attention to any backtip whalers caught in the nets in an attempt to identify Australian blacktip shark *Carcharhinus tilstoni*, which was previously not known from NSW waters. The existence of this species in NSW comes from the genetic studies undertaken by the department's Shark Scientist and Macquarie University undertaking molecular forensics with SMP samples (Boomer *et al*, 2010).

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:
 - Ultraviolet (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 (read, understood and signed by each Observer).
- Kits for specimen dissection and sampling.
- Shark identification books.
- Marine mammal and sea bird identification information resources.
- Mobile phone (for reporting captures / arranging trip dates/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 2010-11 meshing period, each observer was allocated designated observer hours per meshing region as set out in clause 34(2) of the Management Plan. The number of 'allocated' hours and the 'actual' hours worked during the reportable period, as certified by observers on monthly timesheets for the 2010-11 meshing period, are set out in Table 2.

Observers are used mainly on days when nets are being hauled to check what is being caught 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 46% of hauling days, details for each region are provided in Table 2.

Table 2. Observers hours and hauling days present for 2010-11.

Mesning Region	Total No. of days setting and hauling	Total Number of hauling days	No. haul days observer present	Percentage of haul days observers present	Allocated Hours	Actual Hours
Hunter	117	106	43	41%	490	403
Central Coast	117	108	56	52%	630	391.5
Sydney North	115	108	56	52%	315	404.5
Sydney Central	135	133	40	30%	315	532.5
Sydney South*	167	160	73	46%	1225	1309
Illawarra	124	104	65	63%	350	337.5
Total	775	719	346	46%	3325	3378

*Denotes the only full-time observer position in the SMP- further time is allocated for this position up to 35hrs per week for the entire meshing period and includes work on other SMP-related duties.

Variations to allocated hours

Downward and upward variations to the allocated hours can be expected due to inclement / favourable weather and unforeseen events. For example, the Central Coast and Newcastle 'Actual' hours were below the allocated hours as one observer was used for both Central Coast and Newcastle areas for the majority of the year following the resignation of the observer for the Newcastle area.

In 2010-11, a sixth contractor was included in the program for the first time. This resulted in an overrun, or upward variation of hours for Sydney North and Sydney Central areas. The number of hours allocated for these two areas was half the hours allocated for Sydney North region as the two regions were formed by splitting Sydney North into two smaller regions.

On average observers were present during 46% of all net checks (hauls) undertaken by contractors and the 'Actual Hours' worked by all observers was within 2 percent of the total 'Allocated Hours' in the Management Plan.

Outcomes of Observer Program

Outcomes of the Observer Program in achieving progress toward the measures specified in the Management Plan for the 2010-11 meshing season include:

1. All catches of target and non-target species taken in nets by each contractor as submitted by the contractor were authorised by the observer and certified by way of monthly catch data sheets (records held by Fisheries Compliance Unit, Narara).
2. Using hand-held global position units (GPS) the observers provided accurate setting locations of all nets within the area of operation.
3. Details relayed to DPI and OEH for all marine mammals and reptiles captured in nets.
4. Samples of all animals as required and assistance in the delivery of whole animals.

1.1 (c) Compliance Plan (Part 5 of the Management Plan)

A Compliance Plan is required to ensure that the optimal level of compliance with the controls on the activity is achieved as set out in Part 5 (clause 37) of the Management Plan.

Audit and Compliance Checks in 2010-11

Compliance inspections were undertaken prior to and during 2010-11 meshing period. For example:

- An inspection of nets and equipment was undertaken prior to the start of the SMP at which time all contractors complied with current contract conditions.
- Covert operations were coordinated by the Shark Meshing Supervisor as opportunities arose to do so in a cost efficient manner.
- During the helicopter and fixed wing shark surveillance trials conducted in 2010-11 observers were requested to report on any animals entangled in the nets and note any issues or concerns.

Following a number of covert compliance surveillance operations a meeting was held in Cronulla in March 2011 with contractors and observers to discuss some possible reporting inconsistencies. All matters of concern were resolved at the meeting with no further follow up required.

The auditing and compliance checks undertaken during 2010-11 did not reveal any non-compliance with the current provisions of the SMP. Details of the compliance measures undertaken in the 2010-11 meshing period are set out in Table 3.

Table 3. Details of compliance measures undertaken during 2010-11.

Region	Inspection Type	Date
Hunter	14 nets inspected*	27/08/2010
Central Coast	14 nets inspected*	27/08/2010
Sydney North	7 nets inspected*	20/08/2010
Sydney Central	8 nets inspected*	19/08/2010
Illawarra	5 nets inspected*	17/08/2010
Sydney Central & Sydney North	5 nets observed# (Manly, Freshwater, Curl Curl, Mona Vale & Warriewood)	28/09/2010
Sydney Central & Sydney North	All nets observed # (Manly to Palm Beach)	05/10/2010
Sydney Central & Sydney North	All nets observed # (Manly to Palm Beach)	06/10/2010
Sydney Central & Sydney North	4 nets observed# (Manly and Avalon)	07/01/2011
Sydney North	All nets observed # (Palm Beach to Warriewood)	21/01/2011
Sydney Central	4 nets observed# (Manly to Curl Curl)	04/02/2011
Newcastle	3 nets observed # (Merewether to Blacksmiths)	08/02/2011
Illawarra	5 nets observed# (South Wollongong to Coledale)	11/03/2011
Fisheries Patrol Vessel (Sydney Swan)	2 nets sighted (South Wollongong and North Wollongong)	10/04/2011
Illawarra		
Sydney South	8 nets sighted (Garie, Wattamolla, Cronulla, North Cronulla, Maroubra, Coogee, Bronte and Bondi.)	10/04/2011
Sydney Central & Sydney North	All nets sighted (Manly to Palm Beach)	11/04/2011
Sydney Central & Sydney North	All nets sighted (Palm Beach to Manly)	14/04/2011
Aerial surveillance	Fixed wing and helicopter aerial surveillance (all nets)	Each weekend and public holiday over the peak summer holiday period and every Wednesday from 22 December 2010 to 30 January
All regions		

* 'Inspected' means physically inspected by the Shark Meshing Supervisor.

'Observed' means covert surveillance of the netting operation.

Damage to shark net potentially from commercial stern trawlers

Nets in the Hunter region were potentially damaged by commercial stern trawlers during the program in 2008-09, 2009-10 and on one occasion in 2010-11.

In 2010-11 the A4 sized flyer (appendix 1) was distributed to all commercial fishers in the Newcastle area via the Newcastle Fisherman's Co-operative.

The flyer was also placed in the NSW Commercial Fisher's Newsletter in September 2010. This resulted in four Commercial Fishers requesting GPS point of Newcastle nets.

It is anticipated that educational efforts will continue in 2011-12 to reduce net damage.

Interference with shark nets

In September 2010 a net was found washed up on a beach with both anchor lines appearing to be cut at the bridle. This incident was thoroughly investigated by Fisheries Officers who undertook random overt and covert surveillance in the area over a period of 14 days. Fisheries Officers consulted with local lifeguards, surfers and shark meshing contractors to investigate the matter. No further interference with the net was observed and no compliance action was taken.

Another incident of interference with nets occurred in December 2010 at Bondi. It is alleged that around the 9 December 2010 someone (possibly a photographer, film crew member, or Bondi Lifeguard) interfered with the Bondi net resulting in a shark 'dropping out' of the net. Although the carcass was decomposing by the time it washed up onto Bondi beach, the whole carcass was retained for scientific research purposes and included in the SMP catch records. Following an investigation of the incident by the Shark Meshing Supervisor, Lifeguards at Bondi were provided with the appropriate contact details for DPI staff and requested to advise DPI staff of any issues relating to shark nets. Lifeguards were also advised that interfering with a shark net is listed as an offence under the *Fisheries Management (General) Regulation 2010*, carrying a maximum penalty of \$5500.

Non Compliance with Tagging

A grey nurse shark was tagged by mistake in September 2010. The observer recalled the training too late and called the Shark Scientist and Strategy Leader shortly after tagging the shark to advise of the mistake. The Strategy Leader contacted all observers and contractors to remind them not to tag grey nurse sharks.

Due to a misunderstanding, not all angel sharks were tagged during the 2010-11 season. The Strategy Leader noted angel sharks were not being tagged in January and contacted the observers and contractors to remind them of their duties to tag all live sharks (except grey nurse).

A total of 16 sharks were released alive, grey nurse sharks are not meant to be tagged leaving 14 sharks to be tagged, 4 angel sharks were not tagged and 4 sharks escaped the net before tagging could occur. The 6 sharks that were tagged include, one tiger, one smooth hammerhead, one angel shark, one seven gill and two dusky whalers.

Report of net set too close to the surface

It was reported to Fisheries Compliance that one of the shark nets was very close to the surface. As nets are meant to be bottom set the matter was investigated and resolved to the satisfaction of the Shark Meshing Supervisor, there was nil non-compliance with net setting requirements identified during the 2010-11 meshing period.

Non-recovery of turtle carcasses

In 2010, OEH requested that their staff be contacted so that where possible staff can collect all dead turtle carcasses. There were only two occasions where this did not occur and the reasons are as follows:

- 1) NSW Maritime staff noted that there was a turtle in the Caves Beach net while following up a report of a turtle caught in fishing line. NSW Maritime staff did not retain the turtle due to the advanced state of decomposition, photographs were provided to DPI and OEH staff.
- 2) A NSW Fisheries Officer noted a deceased turtle in the Redhead net while following up a report of a possible mammal entanglement in the net. Due to the sea conditions it was considered unsafe for the officer to recover the deceased turtle. The turtle was not present when the contractor checked the net the following morning.

Overall compliance

Compliance with contractual arrangements must be greater than the trigger point of 80% under the Management 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 - around 87% of hauls occurred within 72 hours of nets being set.
- 100% compliance with all covert inspections

All issues were resolved to the satisfaction of the Shark Meshing Supervisor, there was nil non-compliance identified during the 2010-11 meshing period.

1.1 (d) 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 levels (levels 1, 2 or 3) relevant to the risks identified through the environmental assessment process to provide information necessary to support the objectives of the Management Plan:

- a) **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.
- b) **Level 2** (Actions): Immediate and ongoing.
 - i) Research associated with ongoing actions undertaken to implement the Management Plan.
- c) **Level 3** (Applied research): As required to meet the objectives of the Management Plan.
 - i) Research requirements identified from the environmental assessment process to mitigate adverse impacts of the SMP.

Table 4 (overleaf) provides details of progress in achieving the objectives of the Strategic Research and Monitoring Plan.

Table 4. Progress on achieving the objectives of the Strategic Research and Monitoring Plan.

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.	<p>Status: Complete.</p> <p>The sole level 1 component of the <i>Strategic Research and Monitoring Plan</i> (SRMP) was to develop a document to identify research gaps, funding sources and strategic directions. This was completed by DPI's Shark Scientists.</p>
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: Review data collection methods used in the SMP. 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 during 2009 and conducted a workshop on 26 August 2010 to ensure observers and contractors were trained to collect appropriate material for DNA analysis and other uses. A complete wet lab training session was undertaken and a dissection kit was dispensed to each shark meshing boat.</p> <p>2.1.2: Develop refined catch data forms and identification resources. Data catch reporting forms were refined and incorporated into the 2010-11 meshing period 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 Strategy Leader commenced in the 2010-11 meshing period.</p> <p>2.1.3: Identify associated training programs for observers and contractors. The department's 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 new training required for the 2010-11 meshing period for observers and</p>

	<p>contractors was tagging procedures for nominated shark species and disentanglement procedures for non-target species from OEH. Pre-season training days will occur for 2011-12 meshing period.</p>
2.2 Review genetic samples to compare with reported species identification.	<p>2.2.1: Review shark genetic samples held by DPI and cross-reference with reported species identification. Research is being conducted by the department's 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> <ol style="list-style-type: none"> 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. <p>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 intrinsically hard to differentiate. This work resulted in the identification of a new species caught in the SMP, the Australian blacktip shark <i>Carcharhinus tilstoni</i>, which was previously not known from NSW waters. These results were published (Boomer <i>et al</i>, 2010).</p> <p>Further analysis of catch records in relation to reports by contractors, the SMP database, and the genetic species identification are currently underway.</p> <p>Genetic samples of dusky whalers obtained from the SMP also contributed to an international collaboration investigating the global phylogeography of this heavily fished species. These results were published (Benavides <i>et al</i>, 2011).</p> <p>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 '<i>Identifying Sharks and Rays, A Guide for Commercial Fishers</i>' was revisited during the August training day, with particular reference to the training of the new contractor for Sydney Central. 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.</p> <p>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.</p>

<p>2.3 Review data on temporal and spatial factors affecting the operation of the SMP.</p>	<p>Status: Commenced and ongoing.</p> <p>2.3.1: Review research being conducted by CSIRO Marine Research on great white shark movements. DPI works closely with Dr Barry Bruce, principal investigator of the CSIRO Great White Shark Project, supplying data from white sharks caught in the SMP and data of tagged sharks detected on DPI's 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 potentially dangerous 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 Great White Shark Project, pers. comm. July 2010). The CSIRO provides weekly updates of satellite-tagged white shark movements to the DPI's Shark Scientist.</p> <p>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, the DPI's shark biologist is 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. Bull shark movement research is being conducted using acoustic tags and over 400 listening stations that DPI has established in various areas along the coast of NSW. This research was instigated following the attack on the Navy diver in 2009 and will have direct relevance to shark protection and the SMP. 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 23 media presentations during 2010.</p> <p>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, DPI's Shark Scientist keeps abreast of new research outputs or management issues for species likely to be impacted by the SMP.</p>
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2.4 Review data on shark interactions and beach usage.	<p>Status: Commenced and ongoing.</p> <p>2.4.1: Access / review data collection by various organisations. DPI's 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.</p> <p>During the SMP meshing period there were 58 sharks sighted by members of SLS NSW, this is slightly lower than the five year average.</p> <p>Table 5. Number of sharks sighted by SLS NSW.</p> <table border="1" data-bbox="720 551 1558 780"> <thead> <tr> <th data-bbox="720 551 967 621">Region</th><th data-bbox="967 551 1269 621">Shark sightings 2010-11</th><th data-bbox="1269 551 1558 621">Shark sightings 5-year average</th></tr> </thead> <tbody> <tr> <td data-bbox="720 621 967 654">Hunter</td><td data-bbox="967 621 1269 654">9</td><td data-bbox="1269 621 1558 654">5</td></tr> <tr> <td data-bbox="720 654 967 687">Central Coast</td><td data-bbox="967 654 1269 687">16</td><td data-bbox="1269 654 1558 687">10</td></tr> <tr> <td data-bbox="720 687 967 719">Sydney</td><td data-bbox="967 687 1269 719">24</td><td data-bbox="1269 687 1558 719">43</td></tr> <tr> <td data-bbox="720 719 967 752">Illawarra</td><td data-bbox="967 719 1269 752">3</td><td data-bbox="1269 719 1558 752">3</td></tr> <tr> <td data-bbox="720 752 967 780">Total</td><td data-bbox="967 752 1269 780">52</td><td data-bbox="1269 752 1558 780">61</td></tr> </tbody> </table> <p>Further assessment and discussion with SLS NSW is ongoing with a view to refining the Shark Log data capture fields, ensuring consistency of submissions from club to club and whether further data needs to be captured.</p> <p>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 (2009, State of the Environment Report, CoA). An ongoing increase in beach usage in the area of the SMP can be expected into the foreseeable future given these predictions.</p> <p>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 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.</p> <p>SLS NSW provided the beach visitation figures (table 6) for the past five years for the beaches listed in table 7. The beach visitation is recorded at around 1pm for the period 25 September to 25 April each year.</p>	Region	Shark sightings 2010-11	Shark sightings 5-year average	Hunter	9	5	Central Coast	16	10	Sydney	24	43	Illawarra	3	3	Total	52	61
Region	Shark sightings 2010-11	Shark sightings 5-year average																	
Hunter	9	5																	
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Illawarra	3	3																	
Total	52	61																	

Table 6. SLS NSW beach visitation data at around 1pm for the period 25 September to 25 April each year

Region	2006-07	2007-08	2008-09	2009-10	2010-11	5-year average
Hunter	88,645	102,322	140,441	122,910	152,788	121,421
Central Coast	313,682	343,587	278,333	237,751	295,034	293,677
Sydney	1,090,482	1,363,137	1,586,513	1,543,121	2,051,599	1,526,970
Illawarra	25,494	40,837	47,579	123,940	82,543	64,079
Total	1,518,303	1,849,883	2,052,866	2,027,722	2,581,964	2,006,148

Table 7. List of beaches included in NSW SLS beach visitation data (Table 5).

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

	<p>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 is a general upwards trend in beach visitations (table 6).</p> <p><i>2.4.3: Develop better links between agencies and develop systems to optimise collection and use data.</i></p> <p>Better links have been developed between DPI, SLS NSW, APOLA 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.</p> <p>Data and information is shared freely between the groups and coordination of information is increasing during other shark-related matters. These include, 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 a better 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 entrapped marine mammals.</p>
2.5 Review effectiveness of fishing operations used in shark control programs.	<p>Status: Completed - ongoing.</p> <p><i>2.5.1: Review NSW shark meshing net configurations.</i></p> <p>A research project investigating the SMP net configurations with a view to reducing bycatch will be undertaken depending on available funding opportunities and cooperation from contractors.</p> <p><i>2.5.2: 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's Shark Scientist has over 20 years experience in electro-repelling of sharks and is regularly reviewing 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. The data suggest that the electric shark repelling technology presently available may have limited effect 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: Use outcomes to trial gear-related modifications of the SMP. No alternative to physical shark control measures are considered viable to trial.</p>
2.6 Develop methodologies for standardising fishing effort and analysing comparative CPUE data.	<p>Status: Ongoing</p> <p>2.6.1: Investigate the feasibility of standardising soak-times for shark nets. 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.</p> <p>The new JMA requirements will greatly assist in attempts to standardise soak times.</p> <p>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 <i>et al</i>, 2011).</p>

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

Level and Topic	Status and Comment
3.1 Research needs identified (e.g. environmental impacts of shark meshing).	<p>Status: Commenced and ongoing</p> <p>3.1.1: Distribution, abundance, biology and ecology of target species affected by the SMP. Collaborative research initiatives have been established with the CSIRO Great White Shark Research Project investigating inter-annual variability in great white shark presence on the NSW coast using microchemistry of vertebrae. Since 2009-10 the CSIRO researchers have participated in great white shark dissections at the Cronulla Fisheries Research Centre as part of their investigations into the biology and ecology of this species.</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). A research project on the biology and ecology of tiger sharks in NSW is being formulated in collaboration with Macquarie University.</p> <p>A new DPI research project investigating the ecology and movements of bull sharks in NSW has forged strong links with researchers from Griffith University, Queensland, and the 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: Distribution, abundance, biology and ecology of non-target species affected by the SMP. Although non-target species have, to date, not formed the focus of the DPI research efforts, research into wobbegong shark distribution, ecology and movements, is being conducted in collaboration with Macquarie</p>

	<p>University, Sydney Aquarium and OEH.</p> <p>DPI's Shark Scientist has been nominally involved in advising on some Macquarie University cetacean research initiatives and, in collaboration with Macquarie University and OEH, is planning 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 department's 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.</p>
3.2 Establish DNA library of shark species taken in the SMP to improve accuracy of identification.	<p>Status: Competed - ongoing</p> <p><i>3.2.1: Conduct collaborative research with relevant research institutions.</i> An analysis of historical DNA samples taken from sharks caught in the SMP is ongoing in collaboration with Macquarie University. DNA samples from SMP-caught sharks 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><i>3.2.2: Develop SMP DNA library.</i> A shark DNA library incorporating material from the SMP has been established by DPI and currently contains over 500 samples. Accessioning 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.</p>
3.3 Conduct scientifically-based shark attack risk assessment.	<p>Status: Ongoing</p> <p><i>3.3.1: Compile data from research relating to identified high-risk elements.</i> 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, to date, hampered the establishment of a suitable database. Further research in this area requires access to adequate funding.</p> <p><i>3.3.2: Apply standard risk assessment model (i.e. AS/NZ: 4360).</i> A first attempt at applying a standard risk assessment model to potential for shark interaction has been completed with the Royal Australian Navy relating to their diver 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 is based on the risk assessment model as it promotes safe bather practices by informing bathers of the risks and ways to minimise the chance of a close encounter with a shark.</p>

3.4 Conduct morphometrics on sharks and other species caught in the SMP.	<p>Status: Commenced and ongoing</p> <p><i>3.4.1: Identify need for morphometrics in meeting the needs of the SMP.</i> 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.</p> <p><i>3.4.2: Include in research priorities document (1.1) if considered appropriate.</i> 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 newly developed Strategic Research and Monitoring Plan.</p>
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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 commenced in the 2010-11 meshing period. Contractors provided weekly reports of catches or were called each Friday to obtain the report.</p> <p>Note: Longer term solutions for data collection including use of portable electronic devices for reporting and Interactive Voice Response (IVR) system is under development by DPI for applications supporting telephone-based business services. Further development of this program is continuing with a view to provide a shark net capture reporting facility which will allow contractors to telephone a number and key in capture statistics in real time. The information is then automatically sent via Short Message Service to the Shark Meshing Team and OEH representatives. The requirement to use any IVR system when developed is incorporated into the existing contracts.</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 was undertaken in 2010-11, six sharks that were tagged including, one tiger, one smooth hammerhead, one angel shark, one seven gill and two dusky whalers.</p>

	Turtle tagging may be initiated in the future with assistance from OEH.
4. Routine DNA sampling and verification.	<p>Status: Commenced and ongoing.</p> <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 collected identified a new species in NSW Australian blacktip shark (Boomer et al, 2010).</p>
5. Shark vertebral and other tissue samples.	<p>Status: Commenced in 2010-11 meshing period.</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 88 sharks were caught in the nets during the 2010-11 shark meshing season. Sixteen sharks were released alive and, as such, were not sampled. Of the remaining 72 individuals, 5 were not sampled because the animal fell out of the net during the retrieval process before samples could be collected. All threatened and endangered fish species were sampled or whole animals provided for research purposes.</p>
6. Monitoring of all shark attacks.	<p>Status: Ongoing.</p> <p>Where an attack occurs in NSW the department's 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. The 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 2.3 Helicopter and Aerial Surveillance Trial).</p> <p>No new shark control measures have emerged recently that can be reasonably 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 data <i>on shark interactions and beach usage</i>).</p>
11. Threatened Species recovery plan reviews.	<p>Status: Completed.</p> <p><i>Black Cod Recovery Plan</i> The black cod recovery plan was finalised and adopted in February 2011. Black cod have never been reported being caught in the SMP nets and the Fishery 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 black cod as a species affected by the SMP.</p> <p><i>White Shark Recovery Plan</i> The Commonwealth's Draft National Recovery Plan for the White Shark (<i>Carcharodon carcharias</i>) was exhibited in 2010, with the public comment period closing on 29 July 2010. At the time of preparing this report the plan remains a draft document.</p> <p>The draft 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> <p class="list-item-l1">1. <i>Shark control programs to continue to report protected species interactions.</i> All captures are reportable 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 department's website www.dpi.nsw.gov.au.</p> <p class="list-item-l1">2. <i>Maintain the current review process of the effect of shark control programs on other protected species.</i> The SMP is reviewed annually (this report) and a full review of the SMP is scheduled under the JMAS to be</p>

	<p>completed within five years from implementation 1 September 2009. The SMP will continue to operate in accordance with the JMAs and associated Management Plan.</p> <p><i>3. Continue biological recording and sampling of white sharks caught in shark control programs.</i> In accordance with JMAs and Management Plan, all shark captures are recorded and all live sharks are to be tagged. For deceased protected species where possible the whole carcass is to be retrieved and in all instances biological samples collected from deceased captures.</p> <p>In 2010-11 biological samples were collected from all deceased white sharks.</p> <p><i>4. Develop a tagging program for white sharks caught in shark control programs, in conjunction with existing programs.</i> In accordance with JMAs and Management Plan, all live sharks (excluding grey nurse sharks) are to be tagged.</p> <p>In 2010-11 no live white sharks were encountered in the nets.</p> <p><i>5. Continue to evaluate alternatives to lethal methods of shark control.</i> DPI Shark Scientist will continue to monitor alternatives to the SMP for more details refer to section 2.5 Review effectiveness of fishing operations used in shark control programs.</p> <p><i>6. 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> A genetic database has been established and sampling is occurring in the SMP for more details refer to section 2.2 Review genetic samples to compare with reported species identification and a range of collaborative research is being undertaken for more details refer to section 3.1 Research needs identified (e.g. environmental impacts of shark meshing).</p>
	<p><i>Grey Nurse Shark Recovery Plan and Issues Paper - 2010</i> The Grey Nurse Shark Recovery Plan and Issues Paper 2010 was developed as part of the review process for the Grey Nurse Shark Recovery Plan 2002. The actions in the Recovery Plan are substantially based on the material that came out of a Grey Nurse 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. The draft plan is currently undergoing further review and is with the Commonwealth Department of Sustainability, Environment, Water, Population and Communities at the time this report was prepared. The plan has not yet been released for public comment.</p> <p><i>National Plan of Action for the Conservation and Management of Sharks</i> DPI continues to meet national and international commitments in shark conservation and management by implementing and reviewing the National Plan of Action (NPOA) for the Conservation and Management of Sharks (Shark-plan 1) and its ongoing role on the Shark-plan Implementation and Review Committee (SIRC) and the National Shark Recovery Group (NSRG).</p>

	<p>The National Plan of Action for the Conservation and Management of Sharks was adopted in 2004 and had a 5-year life. A review of the plan commenced in 2009, and culminated in the public exhibition of the 2011 National Plan of Action for the Conservation and Management of Sharks. The 2011 draft plan was on public exhibition at the time this report was prepared, with the public comment period closing on 15 July 2011. The draft plan addresses a range of issues and sets out actions to address each of them. Several issues and the associated action required are of relevance to the SMP, each action listed in the draft plan is addressed under the following relevant headings:</p> <p>Issue 1 - Improved identification of shark species by all resource users</p> <p>Action 1. Review existing shark species identification guides (and any in development) with a view to implementing the best available identification guides in all relevant fisheries:</p> <ul style="list-style-type: none"> • ensure guides are culturally appropriate, including the use of Indigenous species names where appropriate. • ensure the best available guides have been provided to relevant user groups, including fishers, processors, compliance officers, observers and scientists. <p>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 '<i>Identifying Sharks and Rays, A Guide for Commercial Fishers</i>' was revisited during the August 2010 training day, with particular reference to the training of the new contractor for Sydney Central. 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 prior to the commencement of the season.</p> <p>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.</p> <p>Action 2. Monitor the effectiveness of identification guides.</p> <p>Observer program ensures effective identifications and whole specimens are regularly collected and delivered directly to the departments Shark Scientist.</p> <p>Scientific research that includes genetic analysis is being undertaken to validate cryptic species and where necessary correct the shark meshing catch database (for more details refer to section 2.2 Review genetic samples to compare with reported species identification).</p> <p>Action 3. Investigate the potential for additional tools for shark identification, such as morphological diagnostic tools or DNA identification kits.</p> <p>Identification guides are provided (refer to Action 1) and in 2010-11 routine DNA sampling of all dead animals</p>
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	<p>and certain species of live sharks began, this was incorporated into the new contract specification.</p> <p>Scientific research that includes genetic analysis is being undertaken with a view to providing a tool that can be used to quickly identify cryptic species (for more details refer to section 2.2 Review genetic samples to compare with reported species identification).</p> <p><i>Issue 2 - Secure, accessible and validated data sets that record all catch data and are consistent over time with compatible resolution between jurisdictions over the full range of each species from all resource users</i></p> <p><i>Action 4. Develop and implement national minimum data standards for all commercial, recreational, bather protection and Indigenous fishing operations that take sharks.</i></p> <p>As a member of the IUCN Shark Specialist Group, DPI's Shark Scientist will cooperate and assist with development and implementation of national standards.</p> <p><i>Action 5. Develop and implement data verification systems with clear objectives and performance measures.</i></p> <p>Observers act to validate data when onboard the vessels. In 2010-11 a database was created to store all shark meshing data – the data is added to the database by one person and validated by a second person. The validated data will be used in 2011-12 to meet the monthly and yearly reporting requirements of the JMA and Management Plan.</p> <p>In addition, scientific research that includes genetic analysis is being undertaken to validate cryptic species and where necessary correct the shark meshing catch database (for more details refer to section 2.2 Review genetic samples to compare with reported species identification).</p> <p><i>Issue 4 - Coordination of shark research</i></p> <p><i>Action 9. Investigate opportunities for collaborative research initiatives to address aims and objective of Shark-plan 2.</i></p> <p>A review of research and information needs, funding requirements and possible sources of funding has been undertaken by DPI's Shark Scientists through a review of the relevant literature and consideration of funding opportunities. Collaborative research initiatives are already being undertaken and it is anticipated that this will continue as a better picture emerges of the research component needs for the SMP.</p> <p><i>Issue 5 - Maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries.</i></p> <p><i>Action 12. Periodic assessment of ecological impacts of shark control programs for bather protection.</i></p> <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 implementation 1 September 2009. The SMP will continue to operate in accordance with the JMAs and associated Management Plan.</p>
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	<p><i>Issue 10 - Assessment of shark handling practices for the conservation and management of sharks</i></p> <p>Action 19. <i>Investigate shark handling practices to identify any areas of concern.</i> All live sharks (except grey nurse) are tagged and released as quickly as possible with minimal handling.</p> <p>Action 20. <i>Implement solutions as required, with consideration of enforcement requirements.</i> The observer program and compliance plan currently provide sufficient enforcement (for more details refer to section 1.1 (b) Observer Program and 1.1 (c) Compliance Plan).</p> <p><i>Issue 14 - Reduce or, where necessary, eliminate shark bycatch</i></p> <p>Action 29. <i>Assess the effectiveness of current shark bycatch reduction measures in reducing shark mortality (including cryptic mortality).</i> In 2010-11 the frequency of net checking was increased to reduce bycatch mortality with nets to be checked at least every 72 hours weather permitting.</p> <p>A review of research and information needs, funding requirements and possible sources of funding has been undertaken by DPI's Shark Scientists through a review of the relevant literature and consideration of funding opportunities. It is anticipated that possible bycatch reduction measures will be included in future research initiatives for the SMP.</p> <p>Action 30. <i>Initiate action (as required) to ensure effective bycatch reduction methods are developed and introduced in all fisheries in which shark are caught as bycatch, giving priority to species identified through risk assessment as 'high risk'.</i> The 2009 review of the SMP resulted in the program being managed in accordance with JMA and an associated Management Plan with the aim to reduce the environmental impacts of the program.</p> <p>Action 31. <i>Promote adoption of effective shark bycatch reduction measures internationally.</i> It is anticipated that any scientific studies undertaken will be published in the relevant scientific literature and in this way be available internationally. In addition, this and other annual reports will be available and accessible internationally through the department's website.</p> <p><i>Issue 15 - Better understanding of effects of shark fishing, control programs for bather protection and management practices on ecosystem structure and function</i></p> <p>Action 32. <i>Undertake periodic assessment/support research of the impact of targeted shark fishing on non-target species (particularly threatened species).</i></p>
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	<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 implementation 1 September 2009.</p> <p>Action 33. Undertake periodic assessment/support research of the impact of fishing operations on structure and function of shark species/stocks.</p> <p>DPI's Shark Scientist has completed a review of research and information needs, funding requirements and possible sources of funding thorough a review of the relevant literature and consideration of funding opportunities. A review investigating trends in catch within various affected shark taxa over 60 years of SMP activity has been published in the scientific literature (Reid <i>et al</i>, 2011).</p> <p>Action 34. <i>Investigate methods for modeling the population ecology of sharks and distinguishing between natural vs fishing induced variation, so as to better understand population status and rates of recovery.</i></p> <p>Research is currently being undertaken to better understand the distribution of great white sharks and bull sharks. For more details refer to section 2.3 <i>Review data on temporal and spatial factors affecting the operation of the SMP</i>. The DPI Shark Scientist participated in a recent population modeling contract for the Critically Endangered grey nurse shark.</p> <p>Action 35. <i>Consider ecosystem structure and function in the development and implementation of management measures.</i></p> <p>DPI's Shark Scientist has completed the <i>Strategic Research and Monitoring Plan</i> the addresses information needs, funding requirements and possible sources of funding thorough a review of the relevant literature and consideration of funding opportunities.</p>
12. Contractor compliance.	<p>Status: Completed for 2010-11 meshing period.</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 period. For more details refer to section 1.1(c) Compliance Plan.</p>
13. Monitor net locations by GPS.	<p>Status: Completed for 2010-11 meshing period.</p> <p>GPS location of nets was completed during 2010 for the 2010-11 meshing period.</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.</p> <p>As required under the JMAs the 2009-10 report was made publicly available via the department's website as required by JMAs.</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 (a) Change in the number of human fatalities or serious injuries resulting from shark attack

The trigger point for this objective is: one (1) fatality or serious injury per meshing season on a meshed beach. A serious injury means injuries from a shark attack that result in a threat to life or limb.

In 2010-11, there were 11 shark bite related incidents recorded in Australia, 10 unprovoked and one provoked incident. There were 5 in NSW, 1 in South Australia and 5 in Western Australia (one of these was recorded as a provoked incident). Of the 5 incidents in NSW, no incidents were recorded at any of the beaches included in the SMP. This data is courtesy of the Australian Shark Attack File, Taronga Conservation Society Australia.

Table 8 provides data for meshed beaches for the past 3 years.

Table 8. Fatal and serious shark attacks in the SMP area of operation in 2008-09 to 2010-11.

Meshing Period	Fatal	Serious	Total	Trend
2008-09	-	3	3	—
2009-10	-	0	0	↓
2010-11	-	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.

1.2 (b) 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 (1) major or minor incident 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 5 days off work.

There was one minor injury and no lost time recorded. The review report is provided below as required by the JMAs.

DPI was advised of another incident but the incident has not been included in this report because the contractor was not engaged in shark meshing operations at the time.

Review Report for OHS incident

A deckhand received a cut from barnacles while freeing a net entangled around the vessels propeller. As the cut required suture the operation ceased for that day and resumed the next day. From discussions undertaken by the DPI's Strategy

Leader with contractors it was noted that this type of injury has occurred in the past but has previously gone unreported.

While the Safety Management Systems (SMS) for contractors address the risk of loss of steering and engine failure the specific risk of net entanglement was not listed in the SMS.

This incident will be discussed at the next induction day for contractors (August 2011) and all contractors will be required to specifically list, assess and address the risk of propeller entanglement in their Safety Management Systems.

1.2 (c) 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 statistics showed a total of 157 animals were reported entangled in the nets during the period from 1 September 2010 to 7 May 2011, of which 59 were released alive (Table 9). Species encountered alive by the contractors were all released, these included two green turtles, two grey nurse sharks, 41 rays, one tiger shark, two broadnose sevengill sharks, four whaler sharks, one thresher shark, one smooth hammerhead, and five angel sharks.

Rays (Myliobatiformes sp.) continue to provide the largest component of all catches in each region (38% over all regions, 68% released alive). Whalers (*Carcharhinus* sp.) accounted for 14% of all catches in each region, hammerhead sharks (*Sphyrna* sp.) accounted for 11% and angel sharks (*Squatina australis*) accounted for 12%. Other species each contributed less than 10% of the total catch as detailed in Table 9.

One grey nurse shark, six great white sharks, five turtles, and two dolphins, were found deceased in the nets.

The indicators in Table 10 (\uparrow \downarrow $-$) show whether the numbers of non-target species or threatened species captured in the nominated meshing period exceeded two times the average annual catch of the preceding 10 years (\uparrow), or whether it is below the two times the 10 year average (\downarrow) or remains constant ($-$). If the number exceeds twice the 10 year average for two consecutive meshing periods the trigger is tripped. No trigger points were tripped for non-target species during the program in 2010-11.

Table 9. All species reported entangled in the beach nets during the program for 2010-11.

Scientific Name	Common Name	Hunter	Central Coast	Sydney North	Sydney Central	Sydney South	Illawarra	Total released alive	Total deceased	Total	% of total *
Target Species											
<i>Carcharhinus brachyurus</i>	bronze whaler shark			1		3	2		6	6	4
<i>Carcharhinus brevipinna</i>	spinner shark					1			1	1	1
<i>Carcharhinus leucas</i>	bull shark				1		1		2	2	1
<i>Carcharhinus limbatus</i>	blacktip shark		1			3	1	2	3	5	3
<i>Carcharhinus obscurus</i>	dusky whaler			1	2		3	2	4	6	4
<i>Carcharhinus</i> sp.	whaler sharks		2						2	2	1
<i>Notorynchus cepedianus</i>	broadnose sevengill shark		5		5		4	2	12	14	9
<i>Carcharodon carcharias</i>	great white shark				1	5			6	6	4
<i>Galeocerdo cuvier</i>	tiger shark			1	1				1	1	1
<i>Isurus</i> sp.	mako shark			1					1	1	1
Non-Target Species											
<i>Alopias vulpinus</i>	thresher shark		1			2		1	2	3	2
<i>Carcharias taurus</i>	grey nurse shark					2	1	2	1	3	2
<i>Sphyrna</i> sp	hammerhead sharks		1			2	2		5	5	3
<i>Sphyrna zygaena</i>	smooth hammerhead shark	3		4	1	3	2	1	12	13	8
<i>Squatina australis</i>	angel shark				11	7	1	5	14	19	12
<i>Tursiops aduncus</i>	bottlenose dolphin	1		1					2	2	1
<i>Chelonia mydas</i>	green turtle				1	1	3		2	3	5
<i>Cheloniidae</i>	turtle	2							2	2	1
<i>Myliobatiformes</i>	unidentified rays						1		1		1
<i>Aetobatus narinari</i>	white spotted eagle ray				1				1		1
<i>Myliobatis australis</i>	eagle ray	4		10	11	25		31	19	50	32
<i>Rhinopteridae</i>	cownose rays				1				1		1
<i>Trygonorrhina</i> sp.	fiddler ray					2		2		2	1
<i>Dasyatis brevicaudata</i>	smooth stingray				2	2		4		4	2
<i>Dasyatis thetidis</i>	black stingray		1					1		1	1
	TOTAL	10	11	20	38	61	17	59	98	157	100

*The percentage (%) has been rounded to nearest whole number.

Table 10: Comparison of non-target and threatened species catch for the past two meshing terms with twice the average annual catch over the past 10 years.

Scientific Name	Common Name	2 x 10-year annual average*	2009-10	2010-11	Trigger point tripped
Threatened Species					
<i>Carcharodon carcharias</i>	great white shark	14	5↓	6↓	No
<i>Carcharias taurus</i>	grey nurse shark	3	2↓	3—	No
Non-Target Species					
<i>Sphyrna lewini</i>	scalloped hammerhead	4	0↓	0↓	No
<i>Sphyrna zygaena</i>	smooth hammerhead	26	11↓	13↓	No
<i>Sphyrna</i> sp.	hammerhead	55	5↓	5↓	No
<i>Alopias</i> sp.	thresher	5	6↑	3↓	No
<i>Squatina australis</i>	angel shark	28	12↓	19↓	No
<i>Heterodontus</i> sp.	Port Jackson	8	6↓	0↓	No
<i>Myliobatiformes</i> sp.	rays	81	44↓	60↓	No
<i>Osteichthyes</i>	finfish	2	0↓	0↓	No
<i>Tursiops truncates</i>	bottlenose dolphin	2	1↓	2—	No
<i>Delphinus delphis</i>	common dolphin	2	1↓	0↓	No
<i>Dugong dugong</i>	Dugong	0	1↑	0—	No
<i>Pinniped</i> sp.	seal	1	1—	0—	No
<i>Cheloniidae</i> sp.	turtle	4	2↓	7↑	No

*The twice 10-yearly annual average is rounded to the nearest whole number and only lists those species caught in the past two meshing periods. Catch data from when the program was first introduced in Sydney in 1937 is in the previous annual reports and the 2009 document entitled 'Report into the NSW Shark Meshing (Bather Protection) Program - Incorporating a review of the existing program and environmental assessment'. In addition, details of decadal trends from 1950-2010 are provided in a recent publication (Reid et al, 2011).

↑ 10-yearly annual average exceeded one of the previous two years.

↓ 10-yearly annual average was less than one of the previous two years.

— 10-yearly annual average was the same as one of the previous two years.

As exact haul times are not recorded the haul times were determined in 24 hour blocks meaning that a net set on Monday and hauled on Tuesday would be considered as 24 hours between setting and hauling. Similarly, if set on Monday and hauled on the Wednesday it would be 48 hours between setting and hauling, an so on.

Beach meshing contractors are required to check their set net every 72 hours weather permitting. The average time between hauls was 49 hours (Table 11) and around 87% of hauls occurred within 72 hours of nets being set. Due to weather conditions the maximum time between sets was 192 hours on 22 occasions - around 0.4% of total number of sets

Table 11: Number of hauls at each beach during the program for 2010-11. The current contracts provide for 104 hauls of each net.

Region	Number of Beaches	Number of Contracted Hauls	Total Number of Hauls	Average time between hauls (hrs)
Hunter Region	10	1040	1040	53
Central Coast	11	1144	1162	53
Sydney North	7	728	728	55
Sydney Central	8	832	884	48
Sydney South	10	1040	1057	41
Illawarra	5	520	520	43
Total	51	5304	5391	49

1.2 (d) Extent to which the reporting requirements are met.

Trigger points and responses:

- i) Monthly catch summary reports to be provided to OEH, the Scientific Committee and the Fisheries Scientific Committee.
DPI provided monthly catch summary reports to Office of Environment and Heritage (OEH) - Department of Premiers and Cabinet (incorporating DECCW), the Scientific Committee and the Fisheries Scientific Committee, during the program in 2010-11. The last monthly report was provided on 25 May 2011 after the conclusion of the meshing period.
- ii) Annual performance report submitted to OEH, the Scientific Committee and the Fisheries Scientific Committee by 31 July each year.

DPI has prepared this annual report with a view to providing it by the required date. A corrected and proofed version of this report will be made available publicly.

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, a 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 public education campaign designed to inform water goers, 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 the information and a SharkSmart brochure (appendix 2) was produced. The brochure is an informative guide that clearly outlines some simple 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.

In 2010-11 the SharkSmart website was reviewed and updated to include a publications section that provides easier access to the department's SMP related publications. The website also has an on-line order function that allows for tailored and effective delivery to any community groups with an interest in providing or stocking the SharkSmart brochures (appendix 2).

Around 20,000 SharkSmart brochures (appendix 2) were delivered through website requests and promotional days such as the Sydney Royal Easter Show. The brochure is an informative guide that clearly outlines some simple, 'common-sense' measures to increase safety in the water.

In addition, in 2010-11 DPI's information sheet on the SMP, *Primefact 147 Shark Meshing (Bather Protection) Program*, was reviewed and updated to include the changes to the meshing program resulting from the implementation of JMAs and associated Management Plan (appendix 3).

2.2 Aerial Surveillance Trial

A series of trials comparing observer shark sighting abilities in fixed wing aircraft and helicopters were evaluated. To ensure flights would be comparable and representative of their usual flight capabilities, the two aircraft flew the same track-line along the coast within minutes of each other. This design was to allow observers in both aircraft to search the same patch of water in similar environmental conditions (sun-glare, sea surface state, wind speeds) and with the maximum opportunity of seeing the same shark. The faster fixed-wing aeroplane flew a few minutes ahead of the helicopter for maximal safety.

Touchdown Helicopters Pty Ltd and Australian Aerial Patrols were engaged through an open tender process to conduct flights over each weekend and public holiday during the high use holiday period. The trial in 2010-11 was planned for 21 days — each weekend and public holiday over the peak summer holiday period and every Wednesday from 22 December 2010 to 30 January 2011. However, due to weather conditions flights did not occur on five of the planned days and flights were aborted part way on another two days.

The experimental design reviewed 10 flights which included both aircraft as per the required experimental design. There were 84 reported shark sightings across all shared flying days. Fixed-wing observers reported 31 sharks, while helicopter observers reported 53 sharks, of which around 80% were hammerheads. There were 14 other sightings where the species could not be confirmed due to the difficulty in identifying sharks in deeper water. In deeper water there are aberrations caused when light enters the water distorting the view of the shark. Two of these may have been whaler 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. While no beaches were closed during the trial, in the Hunter region two beaches were evacuated as a precaution following shark sightings reported from the fixed wing aircraft to SLS NSW. On each occasion SLS NSW launched a rigid hull inflatable vessel to determine the location of the shark and ongoing risk, on each occasion the shark quickly moved into deeper water and bathers subsequently returned to the water.

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 – where possible, accurately identifying species of sharks 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, Surf Life Saving NSW (SLS NSW) and the Australian Professional Ocean Lifeguards Association (APOLA).
- All sightings should be reported by mobile phone to the relevant surf lifesaving group (Surf Life Saving NSW (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 200mm zoom lens) with an attached GPS recorder. Each image must have metadata that includes the date taken.

Due to the inclement weather experienced during the planned aerial survey weeks, around half of the allocated flight time was unused and the power of the planned scientific study was significantly reduced. To address this an additional set of experiments were designed to determine the depth at which sharks would no longer be visible to aerial observers, and then to use this data to determine the distance at which sharks were no longer seen. A draft report of this study was being finalised at the time of preparing this report, the following is provided as a summary from the draft report.

As the real-time tracking of live sharks was logistically and economically impractical, life-size shark analogues (shark replicas) consisting of plywood cut-outs were used. These shark replicas were based on a silhouette tracing of a 2.5m white shark (*Carcharodon carcharias*) caught in the shark nets. This is a potentially dangerous species, the appearance of which should be manifested within the observers' search image. Additionally, the head morphology on some shark replicas was altered to mimic tiger sharks (*Galeocerdo cuvier*) and hammerhead

sharks (*Sphyrna* sp). The hammerhead shape was traced from a display head at the Cronulla Fisheries Research Centre of Excellence.

To reduce the potential impact of inclement weather on the experiments, all manipulative trials were conducted at the northern side of Jervis Bay, NSW (35.0167°S, 150.7311°E). This is a large embayment (~112 km²) with a substrate consisting primarily of sand and seagrass. The topography offers protection from winds and swells.

For depth trials, the shark replicas were deployed in two water depths (6m and 12m) to simulate the depths over which aircraft would be flying during aerial patrols and to assess the impact of water depth on the observer's ability to sight sharks. Water turbidity was measured throughout the day in the shade of the boat using a 25cm secchi disc.

Shark replicas were sunk to 5-6 m depth and slowly brought up to the surface via a system of pulleys from the seabed. The aircraft hovered (helicopter) or orbited (fixed-wing) overhead at 500 ft (150 m) height above the position of the shark replica. Observers would immediately radio the boat crew when the replica was first seen and the depth of the analogue taken.

There was no statistical difference between the two aircraft in the depths at which the shark replicas were seen. The average sighting depths were 2.5 ±0.1 m (SE) for fixed-wing and 2.7 ±0.1 m (SE) for helicopter observers. There was no significant effect of water depth or head-shape on the on the observer's ability to sight the shark replica.

The distance trials were run using a 5 km x 0.25 km grid through which the aircraft were required to fly on predetermined flight paths. Shark replicas were deployed at between 1.8-2.2 m below the water surface (tide dependent) at random positions a minimum of 500 m apart (i.e. ~10 seconds at 100 knot flying speed) within the grid. Their positions were calculated to be distances of 50-500 m from the flight paths. Each aircraft flew three sets of six transects through the grid with a break of approximately 10 minutes between each set while shark replica positions were moved. Fixed-wing aircraft flew at their normal aerial patrol speed (100 knots), but were allowed to circle for sighting confirmation on one set of the daily trials. Helicopters flew at 60 knots for two of the daily survey sets, and at 100 knots for one set to enable direct comparison with the fixed-wing aircraft flying at that speed.

Helicopter observers saw 17.1% of the shark replica, which was 57% more than the 12.5% seen by the fixed-wing crew. Sighting rates declined sharply beyond 150m for both aircraft with less than 10% of shark replica seen beyond 300 m. The higher visibility of the helicopter cockpit allowed more sightings within 50 m of the flight path. Airspeed made minimal difference in the sighting ability of helicopter observers when flying within 250 m of deployed shark replica, but the faster 100 knot speed completely eliminated shark replica sightings at distances over 300 m from the helicopter. There were minimal differences for fixed-wing sighting rates

when they were permitted to orbit to verify sightings. The data collected indicates that the optimal search width is approximately 100 m (from 50 m to 150 m) either side of the aircraft.

Although species identification was requested from the observers, none of the white or tiger shark deployments were successfully identified to 'species'. Only hammerhead shark replica could be accurately identified by body shape.

Observers in neither aircraft were able to accurately estimate distances to the replica sharks, suggesting reliable estimates are extremely difficult to obtain while travelling at speed, even for experienced observers.

No correlation was found between water clarity and shark replica sighting rates for either aircraft. Although there was a negative correlation between wind speed, water surface conditions and sighting rates for helicopter observations, this was not apparent for fixed-wing aircraft observers. However, the lower overall rate of shark replica sightings by the fixed-wing observers suggests that the fixed-wing observers had more difficulties seeing shark replica, even in better sea conditions.

These results suggest that aerial observers have limited ability to detect the presence of submerged animals such as sharks, especially when distant from the aircraft's flight path. Examination of 20 genuine aerial patrols confirmed this concern, with very low shark sighting rates (around 1 sharks per 100 km flown) implying a considerable underestimation of the presence of many of the shark species known to frequent the coastal fringe area.

As the current trial was limited to SMP area, the trial will continue for 2011-12 and include areas outside the SMP to determine if shark sighting rates are consistent outside the area of the SMP. The results of the studies undertaken to date raise serious concerns about the utility of aerial beach patrols as an early warning system for sharks.

3) Recommended Amendments:

Clause 50 of the Management Plan sets out circumstances in which the Management Plan may be amended, these include ‘a recommendation made in the annual performance report’ (Cl 50(1)a)). The following details are required to support a recommendation:

- 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.

A process for creating amendments to trigger points is also established under Part 8, clause 52 (Special Circumstances). Under this process DPI may amend aspects of this Plan that do not result in increases to the total effort of meshing operations, at any time. The following details are required to support a recommendation:

- 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.

3.1 Amendment to Trigger Point 3.

An amendment to Trigger Point 3 is recommended:

The nature of the proposed change

The nature of this recommendation is to change Trigger Point 3 to better reflect the intention of the trigger point which was to provide a safe work environment and maintain the health and safety of employee’s and contractors. It is proposed to revise the definition of minor incidents to be the following:

A minor incident is any incidents that is reportable to NSW WorkCover or an incident that results in 1 day but less than 5 days lost time.

The reason why the proposed change is required

Under the Management Plan the definition of a minor incident is anything less than 5 days lost time, this means that currently even a minor bruise results in the need for a review report.

The effect of making the proposed change

If this recommendation is enacted then a wasteful review is avoided for minor incidents that do not pose a credible risk to worker/contractor health and safety.

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Appendix 1 - A4 flyer to alert commercial fishers to Shark Net locations Readhead / Swansea-Blacksmiths Beaches

Shark Net Alert

Fishing trawler operators are asked to be mindful of the shark nets at the 51 beaches listed in table 1.

Recently shark nets have been damaged in the Newcastle area.

These nets forms part of an important public safety measure but can be damaged by fishing operations, especially during prawn trawling activity.

Reasons to avoid the shark net:

- Damage to the net may put swimmers at increased risk of shark attack**
- Entanglement may result in damage to fishing gear, loss of manoeuvrability and vessel control**
- Interference with set fishing gear is an offence and may result in legal action and replacement costs**

Table 1. The 6 regions and the 51 beaches of the SMP meshed during the 2010-11 meshing period.

Hunter Region	Central Coast	Sydney North	Sydney Central	Sydney South	Illawarra
Stockton	Lakes	Palm	North Narrabeen	Bondi	Coledale
Nobby's	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				

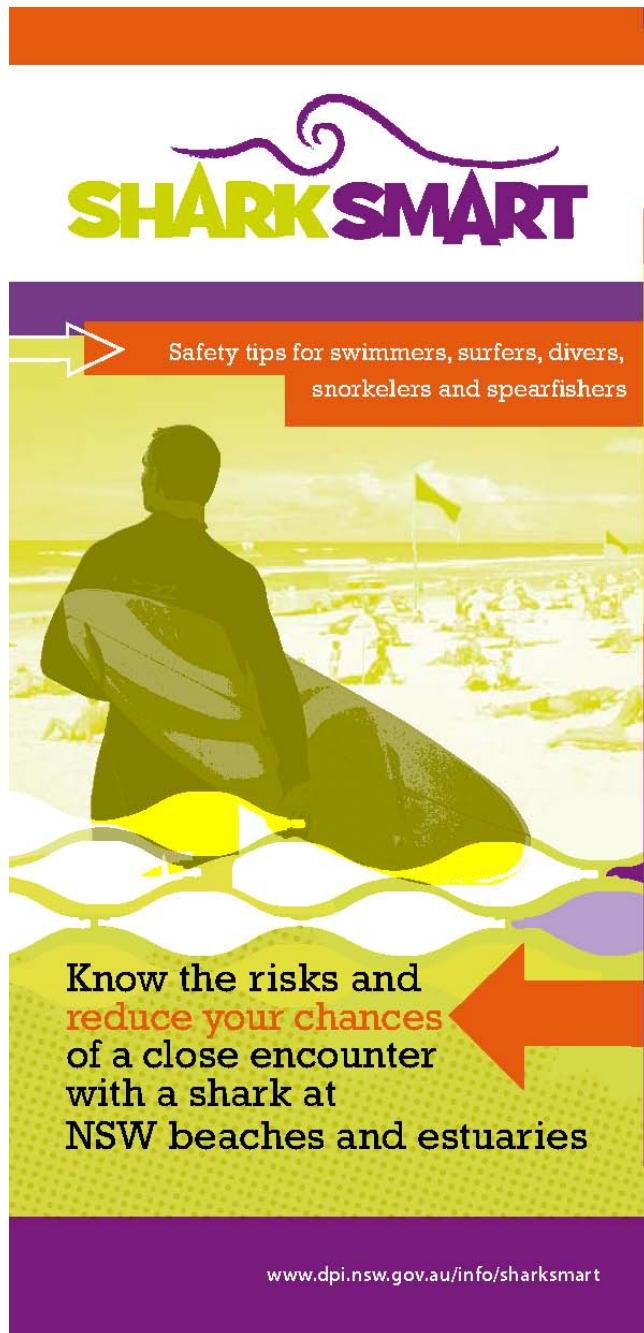
The net is present from 1 September to 30 April each year. It is 150 metres in length and bottom-set. The net is identified at both ends with floats marked "Shark Net".

For further information (e.g. GPS points for the nets) please contact:

John Turpin on 4428 3402 or
Alan Genders on 4916 3973
Fisheries & Compliance Branch
Department of Primary Industries NSW

Thank you for your co-operation.

Appendix 2 - SharkSmart awareness and education program brochure



The brochure cover features the "SHARKSMART" logo at the top, followed by a large image of a surfer walking along a beach. Text on the cover includes "Safety tips for swimmers, surfers, divers, snorkelers and spearfishers" and "Know the risks and reduce your chances of a close encounter with a shark at NSW beaches and estuaries". A website address, www.dpi.nsw.gov.au/info/sharksmart, is also present.

NSW GOVERNMENT | **Industry & Investment**

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.

I&INSW 95/99_SEPT09

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.

AUSTRALIAN LIFEGUARD SERVICE **APOLA** **SHARKSMART**

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

Appendix 2 - SharkSmart awareness and education program brochure (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



Appendix 3 - Primefact 147 Shark Meshing (Bather Protection) Program



NSW Shark Meshing (Bather Protection) Program

How can you reduce the chance of being attacked by a shark?

While shark attacks are exceptionally rare events, there is a risk inherent in swimming in any waterway. The only way that you can 100% guarantee you will not have a shark encounter is not to go into the water.

The fact is that the ocean is a shark's territory. Sharks are a natural part of the ocean environment, and when we enter open waters we are entering their domain – not a swimming pool.

No program or combinations of programs can ever totally eliminate the risk of a shark attack.

One of the simplest things swimmers can do is to stay between the flags when swimming at the beach. This is the best place to swim because the area is patrolled and observed by lifesavers and lifeguards who are there to ensure the safety of swimmers.

Other steps to improve safety at the beach include:

- Don't swim too far from shore – this will isolate you.
- Swim in groups as sharks are more likely to attack an individual.
- Avoid swimming when it's dark or during twilight hours when sharks are most active and have a sensory advantage.
- Avoid murky water, waters with known effluents or sewage and areas that are used by recreational or commercial fishers.
- Avoid areas with signs of baitfish or fish feeding activity – diving seabirds are a good indicator of such activity.
- Do not rely on sightings of dolphins to indicate the absence of sharks – both often feed together on the same food.
- Exercise caution when swimming near steep drop offs – these are favourite hangouts for sharks.
- Do not swim near or interfere with shark nets.

For more information on shark attacks, minimising the risks, statistics and maps, please see:

- [SharkSmart](http://www.dpi.nsw.gov.au/fisheries) – know the risks and minimise your chance of a close encounter with a shark:
<http://www.dpi.nsw.gov.au/fisheries>
- [Australian Shark Attack File \(ASAF\)](http://www.zoo.nsw.gov.au/tcsa/conservation-programs/australian-shark-attack-file.aspx)
<http://www.zoo.nsw.gov.au/tcsa/conservation-programs/australian-shark-attack-file.aspx>
- [International Shark Attack File \(ISAF\)](http://www.flmnh.ufl.edu/fish/Sharks/ISAF/ISAF.htm)
<http://www.flmnh.ufl.edu/fish/Sharks/ISAF/ISAF.htm>
- [Surf Life Saving Fact Sheet 10](http://www.slsa.asn.au/site/_content/resource/00000348-docsource.pdf)
http://www.slsa.asn.au/site/_content/resource/00000348-docsource.pdf

The NSW shark meshing program

The NSW Government's shark meshing program has been effective in helping to provide a safer environment for swimmers and surfers since it was first introduced at most of Sydney's ocean beaches in 1937.

The program involves using specially designed nets along 51 beaches from Newcastle to Wollongong, where the majority of people in NSW swim and surf.

The nets do not stretch from one end of a beach to the other. They are not designed to create a total barrier between bathers and sharks – they are designed to deter sharks from establishing territories, thereby reducing the odds of a shark encounter.

While the nets cannot provide a guarantee that a shark attack will never happen, we believe they have been effective in greatly reducing the number of attacks.

Since the NSW shark meshing program was put in place in 1937, there has only been one fatal attack on a meshed beach. That fatality occurred at Merewether Beach, Newcastle, in 1951.

Before the program was in place, during the period from 1900 to 1936, there was an average of one fatal shark attack every year in NSW waters.



Appendix 3 - Primefact 147 Shark Meshing (Bather Protection) Program (continued)

How the shark meshing program works

Specialist contractors carry out shark meshing operations. The nets are 150 metres long by 6 metres deep and have a mesh size of 60 cm. They are a 'sunk net' set below the surface in about 10 to 12 metres of water, within 500 metres of the shore.

The program extends from 1 September to 30 April each year. The nets are not in place from May to August during the majority of the whale migration season.

The nets are checked regularly by contractors for maintenance purposes and to see if there is any marine life caught in the nets. Contractors are required to free all live marine life found in the nets where it is practical and safe to do so.

Nets may not be in place on every beach every day. They are, however, currently required to be in place at each of the 51 beaches on the weekends to help minimise the risk of a shark encounter during the peak beach period (sea conditions permitting).

The location of the shark meshing nets is determined by the prevailing and forecast wind, sea conditions and currents, generally parallel to beaches near the surf clubs and patrolled swimming areas.

Rough seas can damage the nets so they are put in place only when sea and weather conditions are favourable.

Minimising impacts on other marine life

While the NSW Government remains committed to its shark meshing program, it is also looking for ways to reduce the impact the nets may have on other marine life:

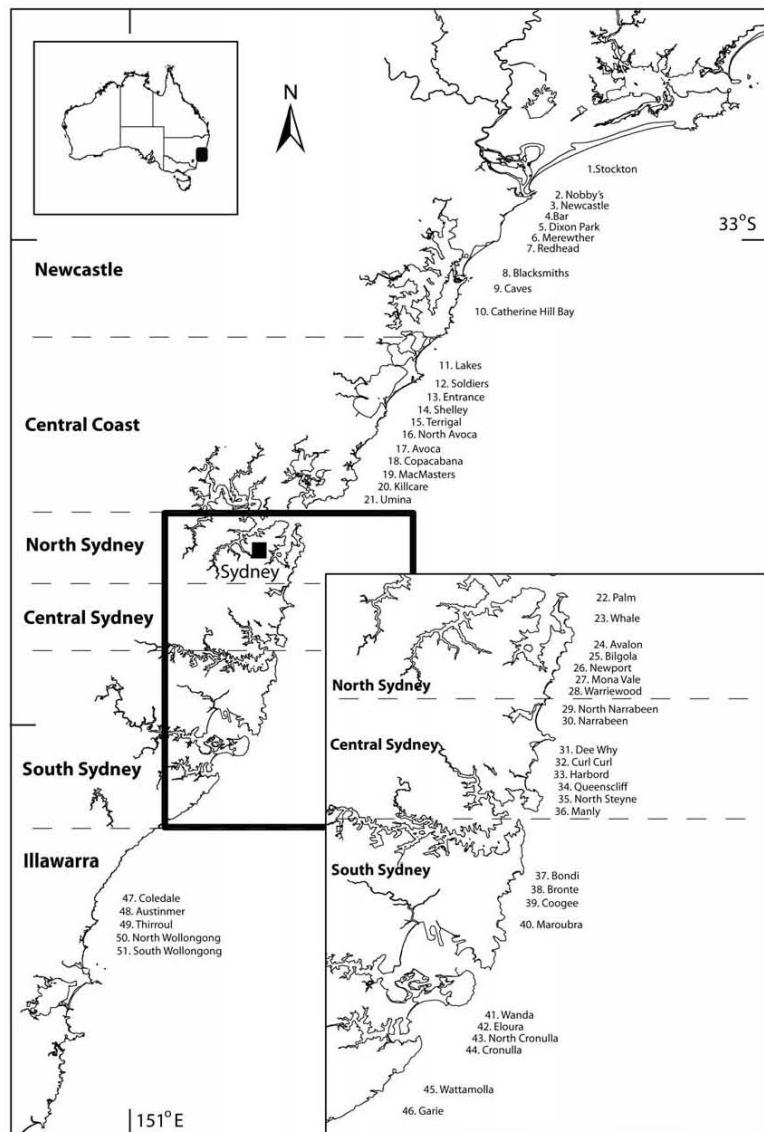
- The program is managed under joint management agreements and a management plan. For more information go to our website:
<http://www.dpi.nsw.gov.au/fisheries>
- Acoustic devices that use high-pitched sonar, known as 'pingers', have been fitted to all nets to alert dolphins.
- Similarly, whale alarms specifically designed to alert whales, which respond to a lower frequency than dolphins, have also been fitted to all nets.
- As nets are set near the sea bed, in about 10 to 12 metres of water, which reduces potential impacts on turtles and other air breathing animals, and further reduces dolphin entanglements.
- Shark meshing nets are not in place during the majority of the whale migration season from May to August.
- The nets are checked regularly by specialist contractors (weather permitting at least every 72 hours).

The six regions and 51 beaches of the Shark Meshing (Bather Protection) Program:

Newcastle	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	
Swansea-Blacksmiths	Copacabana		Manly	Cronulla	
Caves Beach	MacMasters			Wattamolla	
Catherine Hill Bay	Killcare			Garie	
	Umina				

Appendix 3 - Primefact 147 Shark Meshing (Bather Protection) Program (continued)

Figure 1. The map displays the six regions and 51 beaches of the Shark Meshing (Bather Protection) Program.



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ISSN 1832-6668

Check for updates of this Primefact at: www.dpi.nsw.gov.au/primefacts

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2010). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of Industry & Investment NSW or the user's independent adviser.

3 PRIMEFACT 147

Appendix 4 - Changes made in response to the letters from the Committees (refer to Appendix 5 and 6)

In accordance with JMAs clause 8.3 [Measure: Annual Performance Report] the Annual Performance Report was provided to the Scientific Committee, Fisheries Scientific Committee, Minister for Primary Industries and Office of Environment and Heritage (OEH) for comments before 31 July 2011.

The following changes / comments are included to address the issues raised by the committees:

1. *The Fisheries Scientific Committee letter notes ‘... the Annual Performance Report contains little scientific data or information that would allow anyone to assess the success or lack thereof of the program itself.’.*

The annual report is designed to report on the trigger points listed in the JMAs and make this information available to the public. It is not a scientific report. Scientific reports are published in the scientific literature. Recent relevant scientific articles are listed in the *Bibliography* section of this report and scientific publications produced by the department are listed on the department's website: www.trade.nsw.gov.au

2. *The Fisheries Scientific Committee letter notes ‘... the statement that the SMP has been effective at providing a safe environment for swimmers is unsubstantiated because no comparison is made between meshed and unmeshed beaches’.*

The following text was added to section 1.2 (a)Change in the number of human fatalities or serious injuries resulting from shark attack.

In 2010-11, there were 11 shark bite related incidents recorded in Australia, 10 unprovoked and one provoked incident. There were 5 in NSW, 1 in SA and 5 in WA (one of these was recorded as a provoked incident). Of the 5 incidents in NSW, no incidents were recorded at any of the beaches included in the SMP. This data is courtesy of the Australian Shark Attack File, Taronga Conservation Society Australia.

3. *The Fisheries Scientific Committee letter notes that there appears to be some variation in trigger points between what is stated in the footnote of Table 10.*

Only those species caught in the past two meshing periods are included because these are the only species relevant to the trigger point. Also, the 10-year average is rounded to be a whole number because all the data relates to the capture of whole animals.

4. The Fisheries Scientific Committee letter notes that there is no review trigger when catches decline.

The concern raised by the Fisheries Scientific Committee regarding trigger points for decreased catches is noted and will be addressed at the review of the JMAs. However, it should be noted that changes being made to the program are designed to lower the impacts on non-target species. For example whale and dolphin alarms are being used on every net. Also, it should be noted that the reductions in catch in several shark species as referenced by the Committee are over periods exceeding that which would trigger a review, if a similar format for the trigger point is followed.

5. The Fisheries Scientific Committee letter requested some specific reporting:

a) An exploration of whether mortality rate varies with soak times

Combining the variations from year to year with the low number of animals captured and the even lower rates of live release, the effects of soak time on mortality may require several years of data before meaningful interpretations can be made. This request is noted and will be considered during the development of future reports.

b) Understanding of shark movements at individual shark level

Limited data is available on individual shark movements. However, the department is working on ground breaking programs that will assist in this area. This research will be published in the scientific literature.

c) Complied data on unmcheded beaches regarding beach usage rates and shark attacks

The request is noted and DPI staff will continue to work with SLS NSW to improve the information presented on beach usage. While SLS NSW patrols as many beaches as possible not every beach is patrolled so the data available is limited.

6. The Fisheries Scientific Committee letter notes that methods could be altered to have nets set at up to 1m off the bottom to reduce catch of non-target benthic species.

Contractors were advised in August 2011 that nets could be set up to 60 cm from the sea bed to reduce the catch of non-target benthic related animals. As the mesh size is 60 cm raising the net up to 60 cm from the sea bed was considered as being unlikely to adversely affect the functionality of the nets. Some contractors have already voluntarily undertaken this change. Mandatory application of nets being set up to 60 cm above the sea floor will be considered when current contracts expire in 2014.

7. The Fisheries Scientific Committee asked if alternate funding sources have been found to fund science and research and urges government to allocate sufficient funding.

No additional funding sources for scientific research have been identified. In 2011-12 the program has a budget of \$1.4 M that includes funding for the aerial surveillance program and associated science and research program and a technical officer that will work with the Shark Scientist during the 4 months that the beach meshing contractors do not work to assist with research projects and the development of this report.

8. The Scientific Committee stated that it had no recommendation to make in addition to those proposed following the 2009-10 report and provide a copy of the letter.

The issues raised in 2009-10 were addressed in appendix e of the final 2009-10 report. The report is available on the departments website www.trade.nsw.gov.au

The following changes / comments are included to address the issues raised by the committee.

9. Scientific Committee suggested improving the observer data by reporting how many days observers were on vessels.

Table 2 provides the details of allocated and actual observers hours and the number of hauling days that observers have spent on vessels.

The following text is included in the executive summary:

On average observers were present during 46% of all net checks (hauls) undertaken by contractors and the 'Actual Hours' worked by all observers was within 2 percent of the total 'Allocated Hours' in the Management Plan (refer to section 1.1(b) Observer Program).

10. Scientific Committee suggested that there was a lack of available catch data and that the Table was too confusing.

The annual report is designed to report on the trigger points listed in the JMAs and make this information available to the public. It is not a scientific report. Scientific reports are published in the scientific literature. Recent relevant scientific articles are listed in the *Bibliography* section of this report and scientific publications produced by the department are listed on the department's website: www.trade.nsw.gov.au

11. Scientific Committee suggested reviewing the trigger points.

The trigger points in the JMAs were set following extensive consultation. If the trigger points are tripped then a more detailed review report is required. The detailed report could then review information such as the population size, demographic structure, breeding biology and the cumulative effect of other anthropogenic sources of mortality affecting each the species. In addition, much of this data was assessed in the in the 2009 document entitled 'Report into the NSW Shark Meshing (Bather Protection) Program - Incorporating a review of the existing program and environmental assessment'.

12. Scientific Committee suggests discontinuing the program in September.

A number of potentially dangerous sharks are caught in September each year and following the extensive consultation in 2009 the program continues to operate from 1 September to 30 April each year following the stricter controls and reporting requirements as detailed in the JMAs and the associated Management Plan.

13. Scientific Committee suggests that 72 hours is not maximising post-release survival rates for entangled non-target species.

2010-11 was be the first year where 72-hour checking rates are used. As such, it is too early to provide any comments whether this will improve non-target species survival rates.

Combining the variations from year to year with the low number of animals captured and the even lower rates of live release, the effects of soak time on mortality may require several years of data before meaningful interpretations can be made. This request is noted and will be considered during the development of the 2011-12 report.

Appendix 5 - Letter from the 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



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 are 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 2010-11 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 performance and subsequent report. First, the Annual Performance Report contains little scientific data or information that would allow anyone to assess the success or lack thereof of the program itself. The statement that "The SMP has been effective at providing a safer environment for swimmers" is unsubstantiated because no comparison of shark numbers or attacks is made between meshed and unmeshed beaches. This is the same criticism that the FSC had in the 2009-10 assessment of the SMP, but which has not been addressed in the 2010-11 report. We encourage the SMP to provide this information in the 2011-12 Annual Performance Report so that the program can be properly assessed.

Furthermore, we understand the description of trigger points in the last paragraph on page 33, but these appear to be different from the descriptions in the footnote of Table 10 on page 35. The Committee understands that a review is triggered when more than twice the ten-year average is caught in two successive years. We are concerned, however, that no review is triggered when catch rates decline by a similar extent as they have for great white, scalloped hammerhead, smooth hammerhead, hammerhead species, angel sharks, Port Jackson sharks, rays, etc. This is a major concern for the Committee as it may suggest collapse of the populations.

The FSC considers that several of the research projects that commenced in the 2010/11 meshing period are crucial to our understanding of the impact of the program on both individual shark species and NSW shark stocks. The FSC looks forward to receiving the full results of the various studies currently underway relating to aerial surveys and shark movements.

Appendix 5 – continued

The Committee would like specific reporting and analyses on the following key issues:

- Whether the mortality rate is related to set time i.e., higher in nets set more than the prescribed 72 hour soak time and if there are any data on mortality for shorter soak times of 24 hours or 48 hours.
- At the individual shark level, an understanding of shark movements around nets and the beaches of NSW will provide important data to assess public safety and the efficacy of nets in protection from shark attack.
- Compiled data from unmeshed beaches within each management zone on shark sightings, shark attacks and beach usage rates for comparison with data from meshed beaches.

The Committee considers that meshing methods must be altered by setting nets at a depth of one or more metres off the bottom, in order to minimise or eliminate bycatch of rays and benthic non-target shark species.

Has the alternative funding source referred to in the Strategic Research and Monitoring Plan been identified? If not, how does the Government intend to fund ongoing research under the JMA? The FSC is extremely 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 scientifically assess the impact of the SMP, as per the requirements of the JMA and MP. 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.

Yours sincerely



Dr Jane Williamson
Chairperson
Fisheries Scientific Committee
7th November 2011

Appendix 6 - Letter from the Scientific Committee

NSW SCIENTIFIC COMMITTEE

Ms Lisa Corbyn
Chief Executive
Office of Environment and Heritage
PO Box A290
SYDNEY SOUTH NSW 1232

Dear Lisa,

As you will be aware, under the *Threatened Species Conservation Act 1995*, 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 2010-11 Annual Performance Report and has no recommendation to make in addition to those proposed following the 2009-10 report. An ongoing issue of concern to the Committee is the lack of a cost/benefit analysis of shark-meshing during the month of September. Catch reports indicate that capture of non-target and threatened species (especially dolphins and grey-nurse sharks) is particularly high in September, and we expect that the number of bathers is sufficiently low at this time that the benefit to bathers does not outweigh the cost to threatened species. The Committee therefore recommends that the shark-meshing component of the program is discontinued during the month of September, at least at those beaches that are near important habitat areas for non-target species, such as grey nurse shark aggregation sites.

A similar letter has been forwarded to Mr Chris Eccles, Director-General of the Department of Premier and Cabinet.

Yours sincerely



28 NOV 2011

Dr Richard Major
Chairperson
Scientific Committee

sharkmeshing 2011

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 6989

Appendix 6 – continued

NSW SCIENTIFIC COMMITTEE

Shark Meshing (Bather Protection) Program 2009-10 Annual Performance Report

Comments from the NSW Scientific Committee
September 2010

The New South Wales Scientific Committee has reviewed the Annual Performance Report for the Shark Meshing (Bather Protection) Program (SMP) 2009-1010 and provides the following comments.

1. The way in which observer effort is presented in the report makes it very difficult to determine precisely how observers were used during the operation of the program for the 2009-2010 season. For example, from the aggregate figures presented in Table 2 it is not clear that observers were present each time nets were set and hauled, nor is it evident how observer hours were determined. Providing more detail on the observer program in the annual report would improve the transparency of the program and would help substantiate stated outcomes of that aspect of the program.
2. Similarly, the Committee considers that the way in which entanglement rates for threatened species is presented in the report is poor. For example, it is impossible, from the data presented in Table 6, to compare entanglement rates before and after the introduction of the SMP and the use of arrows to graphically indicate whether catch rates have increased or decreased relative to 10 year annual averages is confusing. Once again, the transparency of the program would be greatly enhanced if the annual report simply provided the number of individuals of each species caught each year in, say, the 5 or even 10 years prior to the year of reporting. Surely it would be in the interests of the SMP to clearly demonstrate that measures designed to reduce threatened and non-target species by-catch are indeed working. As the data are currently presented, it is not possible to get an accurate sense of this.
3. The Committee maintains its concern with respect to the way in which trigger points have been set within the program. Trigger points should be sensitive to the population parameters of particular species, however, as they are currently set, they are likely to be too coarse to initiate a change in management response for species with declining or recovering populations. The Committee therefore once again recommends a reconsideration of 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.
4. The Committee re-iterates that meshing should be discontinued during the month of September. A number of non-target and threatened species experience highest rates of mortality during September (e.g. dolphins, grey-nurse sharks). Closure of the program at this time could be supplemented with alternative shark monitoring activities, such as aerial surveillance, which the Committee is encouraged to see being trialled in the current program. As a compromise, shark meshing could be discontinued during September just at those beaches that are near important habitat areas for non-target species, such as grey nurse shark aggregation sites.

sharkmeshing 2010

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 6989

Appendix 6 – continued

NSW SCIENTIFIC COMMITTEE

5. The Committee also wishes to re-iterate that the frequency of net inspections will have a significant influence on the likely post-release survival of non-target species, particularly air-breathing species such as cetaceans, seals and marine turtles. Under the Tender Specifications, nets must be set for a minimum of 12 hours and must be cleared no later than 72 hours after being set. The Committee feels that the upper limit of this condition is not appropriate for maximising post-release survival of entangled non-target species.

sharkmeshing 2010

ESTABLISHED UNDER THE THREATENED SPECIES CONSERVATION ACT 1995

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