NSW GOVERNMENT | Department of Primary Industries

Shark Meshing (Bather Protection) Program 2016/17 Annual Performance Report

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

Published by NSW Department of Primary Industries

Title: *Shark Meshing (Bather Protection) Program 2016/17 Annual Performance Report*

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ISSN 1839-0900

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Acknowledgements

The editors wish to acknowledge the following people for their valuable contribution: Tony Andrews, Christine Rae, Tony Chen, Trevor Daly, Cameron Doak, Surf Life Saving NSW, particularly Donna Wishart and Dean Storey, John West (Curator of the Australian Shark Attack File) and staff from various branches of NSW Department of Primary Industries.

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

INT17/151002

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Executive Summary

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

The JMAs and the Management Plan require an annual performance report to be prepared and submitted to the parties to the JMAs and relevant scientific committees convened under the State's threatened species legislation by 31 July each year.

There were a total of 373 marine life interactions with the SMP during the 2016/17 meshing season. Interactions consisted of 94 with target sharks, and 279 interactions with non-target marine life comprising of; 98 non-target sharks; 165 rays; 5 marine mammals; 10 marine reptiles; and one interaction with 'other non-target marine animals'. Of those 373 interactions, 162 animals (43%) were released alive.

The 94 interactions with target sharks were comprised of: White Sharks; Tiger Sharks; Bull Sharks; Broadnose Sevengill Sharks; Bronze Whalers; Dusky Whalers; Shortfin Makos; Silky Sharks; Spinner Sharks and Common Blacktips.

There were 98 interactions with non-target sharks comprised of: Angel Sharks; Port Jackson Sharks; Smooth Hammerheads; a Scalloped Hammerhead; a Great Hammerhead; Thresher Sharks and Greynurse Sharks.

There were 165 interactions with rays, comprised of: Manta Rays; Southern Eagle Rays; Australian Cownose Rays; Black Stingrays; Short-tailed Torpedo Rays; Shark Rays; White Spotted Eagle Rays and some unidentified rays.

There were five interactions with marine mammals comprised of: 2 Indo-Pacific Bottlenose Dolphins, 2 Common Dolphins and an Australian Fur Seal.

There were 10 interactions with marine reptiles, comprised of: 6 Green Turtles; 2 Hawksbill Turtles; a Loggerhead Turtle and a Leatherback Sea Turtle.

There was one interaction with 'other non-target marine animals' which was a Longtail Tuna.

Fifty-six (56) of the interactions were with threatened or protected species comprised of: 22 White Sharks; 17 Greynurse Sharks; a Great Hammerhead; a Scalloped Hammerhead; 6 Green Turtles; 2 Hawksbill Turtles; a Loggerhead Turtle; a Leatherback Sea Turtle; 2 Indo-Pacific Bottlenose Dolphins; 2 Common Dolphins and an Australian Fur Seal.

The trigger point for the objective of 'minimising the impact on non-target species and threatened species' was tripped in 2016/17 for Greynurse Sharks, Hawksbill Turtles and Smooth Hammerheads (Table 8).

The observer program was implemented with observers present on 34% of all net checks (hauls) undertaken by contractors. Observers continued to focus on ensuring collection of biological samples in accordance with the Strategic Research and Monitoring Program. Biological samples (or whole animals) were taken from 153 of the 211 animals found dead in the nets in 2016/17.

During the 2016/17 financial year there were 12 interactions between humans and sharks reported in NSW waters. Only one of these interactions occurred in the SMP region, however, this incident occurred outside the meshing season. A surfer was bumped off his surfboard by an unknown species of shark at Avoca Beach and suffered no injuries. As such, these incidents did not trip the trigger point related to 'reducing the risk to humans from shark attacks at beaches of the SMP' for the 2016/17 reporting period.

The Management Plan trigger points related to the other objectives of 'minimise OHS risks associated with implementing the SMP' and 'transparent monitoring and reporting' were not tripped in 2016/17.

In 2016/17, DPI met all requirements of the JMAs and associated Management Plan. This report has not identified a need for any amendments to the Management Plan or JMAs.

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. Surf Life Saving NSW figures indicate that an average of almost 3.9 million people annually swam at those beaches over the last six years. Under the current program, 51 beaches between Wollongong and Newcastle (Table 1, Map 1) are netted by contractors using specially designed mesh nets. The aim of the SMP is to reduce the threat of shark attack within the area of the SMP whilst minimising impacts on non-target species. No fatalities have occurred on a meshed beach in over 60 years, and only one fatality has occurred on a meshed beach since the program commenced.

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

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

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

Consequently, there are two JMAs for the SMP. One is between the Minister for Primary Industries and the Director-General of the Department of Primary Industries (DPI). The second is between the Chief Executive of OEH and the Director-General of DPI. The JMAs and Management Plan are publicly available on the shark meshing page of the DPI website.

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

The objectives of the JMAs are to:

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

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

- only carry out shark meshing in accordance with the JMAs and the associated Management Plan.
- only carry out shark meshing during the meshing season (1 September - 30 April of the following year).
- ensure that nets are fitted with acoustic warning devices for cetaceans.

- require that contractors comply with by-catch reduction protocols and release protocols contained in the Management Plan and any release plans.
- continue research into methods of minimising by-catch of non-target species through implementation of the Strategic Research and Monitoring Program contained in the Management Plan.
- provide comprehensive release plans to the parties to the JMAs as required.

The objectives of the Management Plan are to:

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

Table 1 The seven regions and 51 beaches of the SMP meshed in the 2016/17 season.

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

* Denotes that Blacksmiths was historically called Swansea-Blacksmiths

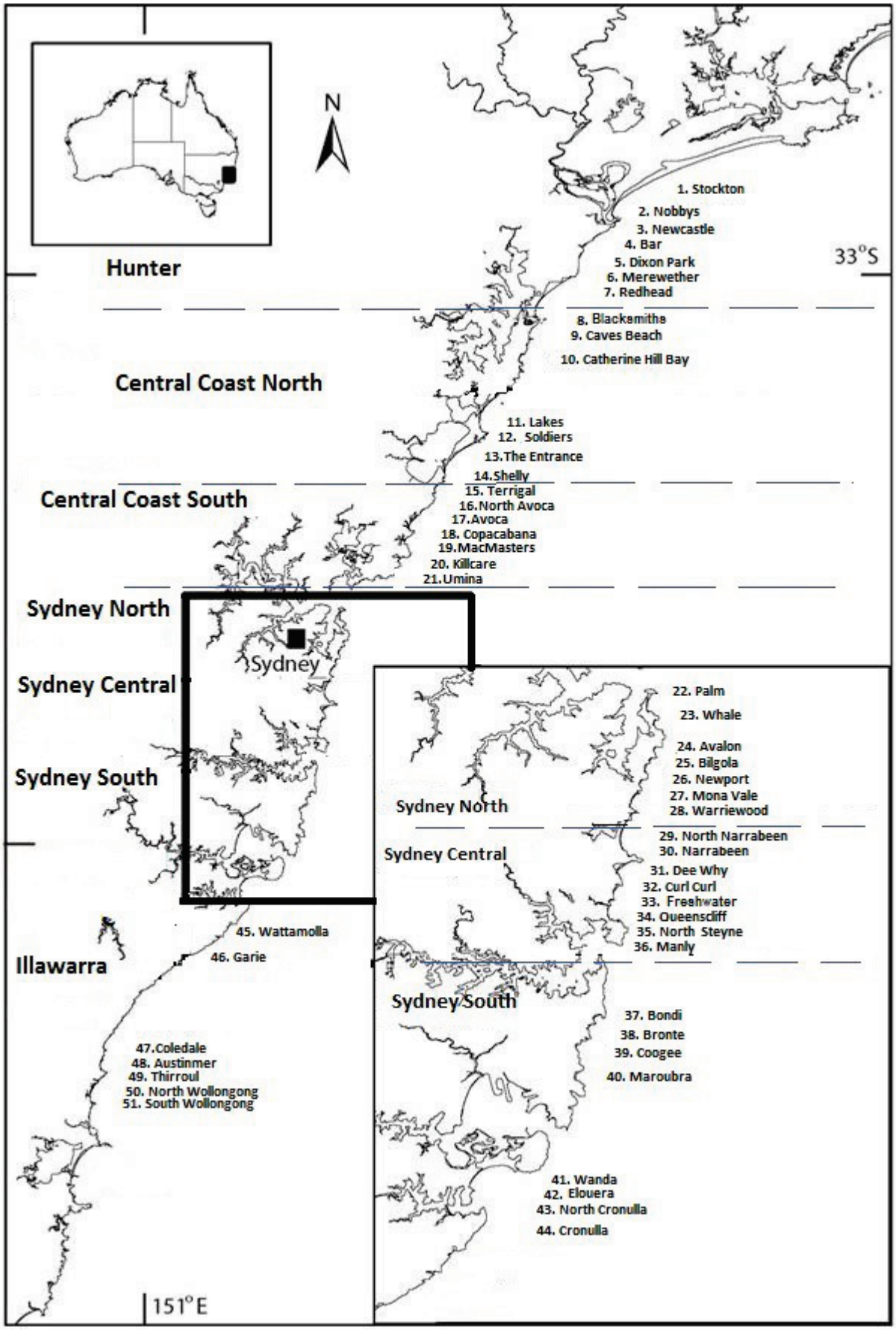

Figure 1 Location of Shark Meshing (Bather Protection) Program beaches.

1 SMP Management Plan Performance Assessment

In accordance with the requirements of the JMAs and the Management Plan, this Annual Performance Report has been prepared for the Fisheries Scientific Committee (FSC) and the Scientific Committee (SC) to inform their annual review of the performance of all parties to the JMAs. The FSC and SC will advise the Minister for Primary Industries and the Chief Executive Officer of OEH, respectively, of any deficiencies in implementation of the JMAs by either party. This report and the advice of the FSC and SC are also publicly available.

1.1 Controls on the Activity

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

- Nets and equipment were inspected prior to the commencement of the season to ensure all contractors were complying with current contract conditions.
- All other aspects of the program related to contract management, restrictions on waters, timing, gear and methods, and environment protection provisions remained in line with the contract as per previous years.
- The 51 nets are now distributed across seven meshing regions instead of six, with net numbers and geographic size of regions more similar, where possible.
- All contractor vessels are required to operate a Vessel Monitoring System (VMS) whilst undertaking meshing activities. The VMS units are owned by DPI, and live monitoring of vessels is conducted by the shark meshing supervisor.
- All vessels are required to carry at least two spare nets before going to sea.
- Contractors are required to own and have inspected a minimum number of nets, depending on the number of nets in their respective region.
- More rigorous auditing processes through cross referencing of VMS data, contractor catch reports, observer reports, and compliance reports.

The following lost or damaged nets were reported during the 2016/17 season. These reports include those where there was apparent interference with nets:

- Central Coast North contractor reported on the 18th October 2016 that the net at Shelly Beach had been damaged; believed to be from a whale.
- Sydney Central contractor reported on the 24th October 2016 that the Queenscliff net had been vandalised.
- Central Coast North contractor reported on the 25th October 2016 that the net at Caves Beach had been damaged; believed to be from a whale.
- Sydney South contractor reported on the 25th October 2016 that the Bronte net had been lost. This net was subsequently found and removed from the water on the 22nd November 2016.
- Central Coast South contractor reported on the 27th January 2017 that the net at MacMasters had been vandalized, with approximately 20m of the mesh being cut along with the float and lead lines.
- Sydney Central contractor reported on the 5th February 2017 that the net at Manly had been tampered with, with one of the marker floats and a dolphin pinger missing.

- Sydney Central contractor reported on the 28th February 2017 that the nets at both Manly and North Steyne had been vandalized with numerous cuts to mesh on both nets.
- Central Coast South contractor reported on 16th February 2017 that the net at Avoca Beach had been vandalized with approximately 15m of the mesh and the lead line being cut.
- Central Coast North contractor reported on 20th March 2017 that the net at Lakes had been lost. This net was subsequently found on the 21st March 2017.
- Sydney Central contractor reported on 24th March 2017 that the net at Queenscliff had been severely vandalized being cut in numerous places throughout the mesh.
- Illawarra contractor reported on the 3rd April 2017 that the net at Garie had been damaged. Contractor suspects that it may have been damaged by a large shark.

1.2 Observer Program

The Management Plan requires an Observer Program to operate as part of the SMP.

Temporary Employment of Observers

To satisfy the Observer Program requirements, four people were engaged by way of temporary employment for the eight months of the SMP. Three of the positions were casual positions, with the fourth position being retained as a temporary full-time position for 12 months. Two observers conducted their duties predominantly in the Hunter, Central Coast North and Central Coast South regions, with the other two observers in the Sydney North, Sydney Central, Sydney South and Illawarra regions; however, observers were not restricted to specific regions and were used across all regions as required and when available. The temporary full-time position also assisted the Shark Scientist with collation of data, dissections and cataloguing of collected biological samples, purchasing and maintaining acoustic alarms and other duties associated with the SMP.

Training of Observers

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

To ensure the observers were competent and resourced to safely undertake the duties prescribed in the Observer Program for the 2016/17 meshing season, DPI conducted a training day on 17 August 2016 at the Sydney Institute of Marine Sciences, Mosman. Both the observers and contractors attended this day. The day broadly covered management changes; contract management; administration; threatened species and research requirements.

Number of Observer Days

Observers were present for 34% of all net inspections by contractors during the 2016/17 season. A breakdown by region of observer coverage is provided in Table 2.

Table 2 Total net inspections by region during 2016/17 meshing season.

Meshing Region	Total no. of net Inspections	No. of net inspections with observer present	% of net inspections observed
Hunter	725	302	42%
Central Coast North	728	273	38%
Central Coast South	728	301	41%
Sydney North	728	203	28%
Sydney Central	832	312	38%
Sydney South	832	232	28%
Illawarra	728	189	26%
Total	**5301**	**1812**	**34%**

Outcomes of Observer Program

Outcomes of the Observer Program for the 2016/17 meshing season include:

1. Catches of target and non-target species taken in nets were certified by the observer where they were present at the time and included in monthly catch data sheets (records held by Fisheries Compliance Unit, Ourimbah).
2. The observers provided accurate details for all witnessed net inspections using iPhones equipped with a customised data recording application. All the data are uploaded and stored on the Fisheries Compliance Database. Figure 2 shows the catch numbers recorded by the contractors when an observer was present versus absent.
3. Details for all marine mammals and reptiles captured in nets were relayed to DPI and OEH via a monthly report.
4. Collection of 125 biological samples and 28 whole animals.

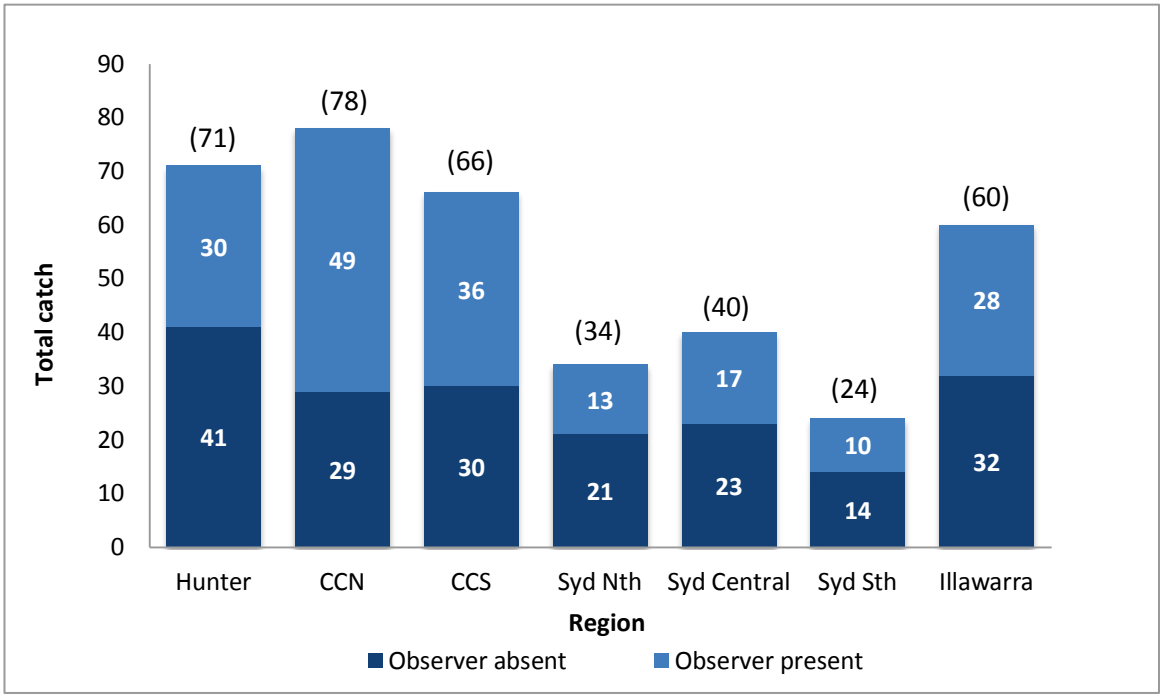

Figure 2 Total catch recorded by contractor when observer present or absent during 2016/17 meshing season.

1.3 Compliance Plan

The Management Plan requires a Compliance Plan to be implemented as part of the SMP.

Audit and Compliance Checks in 2016/17

Compliance inspections were undertaken prior to and during the 2016/17 meshing season.

- Pre-season checks of the contractors' nets were conducted by the Shark Meshing Program Supervisor and/or Fisheries Officers. A small number of minor issues were detected during these inspections with some being rectified on the spot, and others requiring reinspection of the nets. All nets complied with current contract conditions prior to the commencement of the 2016/17 meshing season
- Fisheries officers physically inspected 38 of the 51 SMP mesh nets from offshore patrol vessels or on board the contractor's vessels.
- Fisheries Officers and the Shark Meshing Program Supervisor conducted numerous overt and covert inspections of the contractors' operations throughout the meshing season. Fisheries officers were also encouraged throughout the season to carry out random, thorough inspections of the mesh nets during their routine patrol work. All inspections were recorded on smart devices using a customised data recording application. All the data were uploaded and stored on the Fisheries Compliance Database.

A total of 112 inspections were undertaken across the seven regions, with 93% of the inspections showing that contractors were complying with the Management Plan. The most compliant region was Sydney South, while the least compliant was Central Coast South (Table 3).

Table 3 Frequency of compliance inspections and percentage compliance by region during 2016/17.

Region	Inspection Count	Comply	Non-comply		% Comply
			pre-season	meshing season	
Hunter	14	13	1	-	93%
Central Coast North	20	19	1	-	95%
Central Coast South	12	10	1	1	83%
Sydney North	22	21	-	1	95%
Sydney Central	28	26	1	1	93%
Sydney South	3	3	-	-	100%
Illawarra	13	12	1	-	92%
Total	**112**	**104**	**5**	**3**	**93%**

Beach meshing contractors are required to check their set nets every 72 hours, weather permitting. This commitment was met on the majority of occasions with 94% of set net inspections taking place within the 72 hour timeframe. The reasoning provided where this requirement was not being met was mostly due to severe weather conditions with two other occasions due to vessel breakdowns. These breakdowns were fixed, or a replacement vessel used, to inspect the set nets on the next day. The intention of the 72 hour inspection timeframes is to potentially increase the chances of survival of any marine life caught in the nets.

Overall Compliance

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

Compliance by all contractors exceeded 80% for the following tasks:

- The compliance rate for the size, length, and marking of nets was 94%. This rate is attributed to minor issues detected during the pre-season inspections of the contractors' nets, which were rectified by the contractors and confirmed through re-inspection. The remaining non-compliance issues related to two instances of dirty floats and one of a hole in a net; which was observed by Fisheries Officers prior to the contractor replacing the net on the same day.
- The compliance rate for dolphin pinger and whale alarms presence and placement was 100%.
- The overall compliance rate by contractors was 93% (Table 3) in accordance with the Shark Meshing (Bather Protection) Program Compliance Plan, which specifies that the rate of compliance will be calculated on a per/100 basis (e.g. if there is non-compliance detected in one of every ten inspections the compliance rate will be recorded at 90%).
- The 93% compliance rate includes pre-season 'on land' net inspections, before the nets were set. As mentioned earlier, this year a number of minor issues were detected during the pre-season inspections. If these inspections are not taken into account and only the inspections that took place while the contractors were in the operational part of the season, the compliance rate was 97%.
- The Contractors are required to comply with a range of specifications under the contract outside of routine overt and covert inspections. Investigations conducted by the Shark Meshing Supervisor detected two instances of non-compliance with the Contract. Both these instances were associated with one contractor and included; failing to have his nets set on the first day of the 2016/17 meshing season; and failing to take adequate photographs of live animals released from the nets. In this case the contractor was interviewed and a formal warning was issued and recorded.

All non-compliance issues in 2016/17 were resolved to the satisfaction of the Shark Meshing Supervisor.

1.4 Strategic Research and Monitoring Program

The Management Plan requires a Strategic Research and Monitoring Program to be implemented as part of the SMP. 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.

Details of the SRMP research topics and their current status are provided in Table 4, and the outcomes of the SMP Monitoring Program for 2016/17 are provided in Table 5.

Table 4 Strategic Research and Monitoring Program Research Topics and Current Status.

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	Status: **Complete** Reported in the 2010/11 Report.

Level 2: Data collection and review of existing data	
Level and Topic	**Status and Comment**
2.1 Review and refine data collection methods	Status: **Ongoing**. ***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. Following the successful implementation of photographing each animal captured during the 2015/16 SMP season, the use of photographs to confirm species identification was continued in the 2016/17 SMP season. ***2.1.2: Develop refined catch data forms and identification resources.*** Catch data forms and instructions for use were provided at the pre-season training days for observers and contractors. New skate and ray identification aids were supplied to contractors to assist in correct identification for the catch records. Weekly catch reporting to the Shark Meshing Program Supervisor continued in the 2016/17 SMP season. ***2.1.3: Identify associated training programs for observers and contractors.*** The most notable training requirement for the 2016/17 SMP season for observers and contractors was reiterating tagging procedures for nominated shark species and disentanglement procedures for non-target species provided by OEH. The release of 43% of animals alive from the SMP nets highlights the relevance and importance of these protocol reviews.

Level 2: Data collection and review of existing data	
2.2 Review genetic samples to compare with reported species identification.	Status: **Ongoing**. ***2.2.1: Review shark genetic samples held by DPI and cross-reference with reported species identification.*** General research has continued into molecular forensics for Hammerhead Shark captures in the NSW SMP. These species identifications using molecular techniques will be compared with identification using photographs to determine the efficacy of photo-identification as a cheap and rapid identification protocol that allows monthly reports to accurately reflect catches. Genetic samples are used for longer term projects and are made available on request to researchers from around the world. Further review of genetic samples and ongoing use for species identification has been limited due to funding. However, the ability to obtain good quality photographs and sharing of these via mobile phone technology for rapid confirmation by scientists has exceeded genetic technique capabilities for rapid confirmation of catch data accuracy. ***2.2.2: Identify associated training programs/resources for observers and contractors.*** Training of contractors and observers in 2016/17 has been designed to improve accuracy of shark and ray identification. The use of the DPI publication '*Identifying Sharks and Rays, A Guide for Commercial Fishers*' was revisited during the training day for observers and contractors in August 2016. Each contractor was provided with a copy of the identification book and the new DPI skate and ray identification guide to be kept on their meshing boat.

Level 2: Data collection and review of existing data	
2.3 Review data on temporal and spatial factors affecting the operation of the SMP.	Status: **Ongoing.** ***2.3.1: Review research being conducted on White Shark movements.*** DPI works closely with the CSIRO White Shark Project, supplying data from White Sharks caught in the SMP and data of tagged sharks detected on DPI arrays of underwater acoustic listening stations. Although the CSIRO research is yet to be finalised, the results of these studies to date 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 to early January, and resident in Victoria from January through April. Since September 2015, NSW DPI has initiated a new $16 million Shark Management Strategy which incorporates tagging and tracking of the three target shark species (White, Tiger and Bull Sharks). Over 100 White Sharks have been tagged, initially in collaboration with CSIRO. Satellite tracks of tagged sharks are publically available at: http://www.wildlifetracking.org/index.shtml?project_id=1141&dyn=1461198575. These movement data will be analysed with IMOS environmental data in 2017/18 as part of a RAAP PostDoc study. ***2.3.2: Review existing data on other species (e.g. Tiger Shark, Bull Shark).*** There have been no substantial increases in knowledge or research on Tiger Sharks in NSW in 2016/17 that would affect the operations of the SMP; however SMP samples did contribute to the first study of population structure and connectivity of Tiger Sharks for the east coast of Australia (Holmes *et al*., 2017 doi:10.1098/rsos.170309). This study indicated that there was no genetic structuring within the Indo-Pacific Ocean basin, suggesting that the small annual Tiger Shark catch in the SMP is unlikely to substantially affect the viability of this large homogeneous east Australian population. These results corroborate the findings of large-scale movements of tagged Tiger Sharks in eastern Australia with individuals of all size classes moving between the SMP region, southern Queensland and New Caledonia *(Holmes et al., 2014 DOI 10.1007/s00227-014-2536-1).* DPI has continued Bull Shark movement research using acoustic tags and over 700 listening stations that DPI has established along the NSW coast. 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 several presentations and television documentaries. A scientific manuscript detailing patterns of occurrence of sharks in Sydney Harbour was published in 2016 in the international journal, PLOS ONE (Smoothey *et al.,* 2016 doi:10.1371/journal.pone.0146911). The number of tagged Bull Sharks is increasing as a result of the tagging research component of the new $16 Million Shark Management Strategy with all tagged target sharks being reported in real-time via the 21 VR4G listening stations moored off beaches in NSW. Analyses of tagged Bull Shark movements and habitat use in relation to life history stage and environmental conditions will considerably enhance understanding of factors affecting bather safety from potential shark interactions. In an effort to increase cross-jurisdictional collaboration and understanding of large-scale movements of Bull Sharks, DPI scientists are collaborating with Queensland shark scientists tagging and tracking Bull Sharks. This collaboration has revealed that Bull Sharks tagged by DPI in the Sydney region are travelling north of Townsville, while Bull Sharks tagged in Queensland are likely to travel into the SMP region. This collaboration has resulted in publication of a manuscript in the scientific journal Frontiers in Marine Science (Heupel *et al.,* 2015 doi:10.3389/fmars.2015.00012) with a second manuscript in preparation.

Level 2: Data collection and review of existing data

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 reviewed where possible given available resources. A study using the SMP catch data to investigate ecological and environmental drivers for juvenile Smooth Hammerhead Shark distribution in temperate NSW was completed as a chapter in a Masters Degree through the University of Newcastle. This new information will not affect the operation of the SMP.

2.4 Review data on shark interactions and beach usage.

Status: **Ongoing.**

2.4.1: *Access / review data collection by various organisations*

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

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

Shark sightings					
Region	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
Hunter	21	33	60	28	8
Central Coast	12	38	29	24	1
Sydney	46	46	46	58	8
Illawarra	3	7	4	7	0
Total	**82**	**124**	**139**	**117**	**17**

The reduced number of shark sightings in the SLS NSW database for the current reporting period (2016/17) reflects a change in the way SLSNSW records shark sightings on patrolled beaches. This was brought about as the number of reported sightings reached a level where it impacted upon the incident management process within the State Operations Centre (SOC). Patrollers and the general public, presumably following heightened awareness from media focus, were communicating several **unconfirmed** sightings daily. As a result, SLSNSW started recording only sightings where a lifesaver or lifeguard was able to confirm the presence of a shark by a second sighting.

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

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

SLS NSW provided the following beach visitation figures for the past eight years for the beaches listed. The recorded beach visitation is the combined total of attendance as assessed in the morning at the start of each patrol, the mid patrol point (1pm) and in the evening at the end of each patrol for the period 25 September to 25 April of the next consecutive year. The average summer beach visitation within the area of the SMP over the last eight years has increased to over 6 million people per annum.

Visitations								
Region	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
Hunter	122,910	152,788	286,798	360,549	741,444	690,343	728,803	764,529
Central Coast	237,751	295,034	412,764	1,095,724	1,260,034	1,241,243	1,145,309	1,173,890
Sydney	1,543,121	2,051,599	1,783,692	2,483,113	3,488,837	3,897,491	3,681,255	3,743,419
Illawarra	123,940	82,543	105,273	132,628	304,703	392,447	363,194	380,299
Total	**2,027,722**	**2,581,964**	**2,588,527**	**4,072,014**	**5,795,018**	**6,221,524**	**5,918,561**	**6,062,137**

Beaches included in NSW SLS beach visitation data

Hunter: Birubi Point, Catherine Hill Bay, Caves Beach, Cooks Hill, Dixon Park, Fingal Beach, Merewether, Newcastle, Nobbys, Redhead, Stockton, Swansea Belmont, Tea Gardens/ Hawks Nest.

Central Coast: Avoca Beach, Copacabana, Killcare, MacMasters, North Avoca, North Entrance, Ocean Beach, Shelly Beach, Soldiers Beach, Terrigal, The Entrance, The Lakes, Toowoon Bay, Umina, Wamberal.

Sydney: Avalon Beach, Bilgola Beach, Bondi, Bronte, Bungan Beach, Burning Palms, Clovelly, Collaroy, Coogee, Cronulla, Dee Why, Elouera, Era, Freshwater, Garie, Long Reef, Manly, Maroubra, Mona Vale, Narrabeen, Newport, North Bondi, North Cronulla, North Curl Curl, , North Narrabeen, North Palm Beach, North Steyne, Palm Beach, Queenscliff, South Curl Curl, South Maroubra, South Narrabeen, Tamarama, Warriewood, Wanda, Whale Beach.

Illawarra: Austinmer, Bellambi, Bulli, Coalcliff, Coledale, Corrimal, Fairy Meadows, Helensburgh Stanwell, North Wollongong, Port Kembla (NSW), Sandon Point, Scarborough Wombarra, Thirroul, Towradgi, Windang, Wollongong City, Woonona.

Data obtained to date on shark interactions/sightings and beach usage has not indicated that any changes are required to the operation of the SMP

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

Productive relationships have been established between DPI, SLS NSW (volunteers and paid lifeguards), Council Lifeguard Services, and the Australian Shark Attack File. Data and information is shared freely between the groups and coordination of information is improving for shark attack responses and the provision of 'real-time' information to surf life saving groups during the aerial surveys. During 2015/16, the DPI Shark Scientist collaborated with the Lake Macquarie Council to develop procedures for the potential use of drones in shark attack mitigation and bather safety as part of the initiatives undertaken by the new $16 Million NSW Shark Management Strategy. These collaborations extended to developing a state-wide protocol for paid lifeguards during 2016/17.

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Level 2: Data collection and review of existing data	
2.5 Review effectiveness of fishing operations used in shark control programs	Status: **Ongoing.** **2.5.1:** ***Review NSW shark meshing net configurations.*** Amendments to net configurations would be outside the scope of existing contracts for the SMP, however, further research on SMP net configurations will be undertaken pending contractor cooperation. **2.5.2:** ***Review the application of other shark control measures for use in NSW (e.g. drum lines).*** The DPI Shark Scientist has over 20 years of experience in electro-repelling of sharks and regularly reviews any new technologies that may assist in developing non-lethal shark control measures. All data to date suggest that the electric shark repelling technology presently available may be of limited effectiveness in NSW coastal waters; however, collaboration with the KwaZulu-Natal Sharks Board has been ongoing with the aim to test their newly developed electric cable in NSW waters. The new $16 Million Shark Management Strategy incorporates opportunity to test any new developments in this technology and will be used if/when a new product(s) is available. The use of drum lines is not currently permitted under the operation of the SMP through the JMA and Management Plan, which prohibit contractors from using baits or lures. The NSW DPI Shark Scientist has however remained in regular contact during 2016/17 with colleagues in both Brazil and Reunion to keep updated on the success of shark attack mitigation products such as the new 'Catch-A-Live'™ drum line system being developed by the Reunion Island Regional Committee for Sea Fisheries and Aquaculture (CRPMEM) (Perry *et al.*, 2014). This technology has been rebranded as the SMART (Shark Management Alert in Real Time) drumline under the NSW Shark Management Strategy and has been successfully tested in estuarine and coastal waters with no turtle or marine mammal bycatch to date. The SMART drumlines have successfully captured Bull, Tiger and White Sharks of different sizes (largest was a 3.6m White Shark) as part of scientific testing of this technology. SMART drumlines are now incorporated into the shark bite mitigation strategy along the NSW coast. All sharks captured, tagged, and translocated offshore before release have subsequently been detected via their tag, indicating that most have survived the process. One individual was found dead on a beach several days after being tagged and released; a necropsy did not provide any indications of the cause of death. It is envisaged that this technology may eventually be trialled within the SMP region incorporating an experimental design to test their efficacy in relation to the nets currently used in this region. **2.5.3:** ***Use the outcomes of those reviews to trial gear-related modifications of the SMP.*** DPI representatives participated in a stakeholder meeting during 2014/15 to discuss new alternative technologies to the currently used shark mesh nets. Although several new technologies were highlighted as potential candidates for replacing shark nets, these have not been scientifically tested in a robust manner, either against free-ranging sharks or the large surf frequently encountered off the NSW coast. Following the NSW Government announcement of support for investigations into alternative methods to mitigate shark attack, an independent review of currently available technologies was conducted by Cardno Pty Ltd. http://www.dpi.nsw.gov.au/data/assets/pdf_file/0020/621407/cardno-review-of-bather-protection-technologies.pdf. This independent review was followed by a stakeholder workshop to identify potential candidate technologies that may be trialled off NSW beaches in future. The $16 Million Shark Management Strategy was subsequently announced by the NSW government which has incorporated testing of several innovative approaches to provide the most effective shark attack mitigation measures at NSW beaches http://www.dpi.nsw.gov.au/fishing/sharks/management.

2.6 Develop methodologies for standardising fishing effort and analysing comparative CPUE data.	**Status: Completed** **2.6.1:** ***Investigate the feasibility of standardising soak-times for shark nets.*** Soak times were standardised in 2014/15 as part of the season contracts with contractors required to check their set nets every 72 hours weather permitting. These standardised procedures were continued throughout the 2016/17 season. **2.6.2:** ***Develop alternative approaches to standardised soak-times.*** No alternative approaches were developed.
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).	Status: **Ongoing** ***3.1.1: Distribution, abundance, biology and ecology of target species affected by the SMP.*** Collaborative research initiatives have been established with the CSIRO White Shark Research Project investigating inter-annual variability in White Shark presence on the NSW coast using microchemistry of vertebrae. This collaboration led to completion of a BSc (Hons) project through the University of Technology entitled: 'Age, growth and movement signatures of the White Shark (*Carcharodon carcharias*) in southern Australia'. This research is being prepared for publication in a scientific journal. Following on from the first estimation of effective population sizes for Australian White Sharks (Blower *et al.*, 2012), collaboration with CSIRO using samples from White Sharks caught in the SMP has led to a novel technique to estimate the total population size for eastern Australia and New Zealand using close-kin mark-recapture via genetic methods. This work has been submitted for publication. In collaboration with Macquarie University, aerial surveys were conducted between Seal Rocks and Stockton which represent the nursery grounds for White Sharks on the Australian east coast. These surveys were primarily focussed on determining effective aircraft speed for marine wildlife surveys, but data will contribute to the CSIRO and University of Technology Sydney aerial survey database. This work led to a MRES degree being awarded with Distinction. Samples from White Sharks caught in the NSW SMP have also contributed to a Southern Cross University study in 2014/15 investigating levels of metal and metalloid pollution in sharks off NSW (Gilbert *et al.*, 2015b polychlorinated biphenyls (PCBs) (Gilbert *et al.*, 2015a). Collaboration is ongoing with the South East Queensland Tiger Shark Research Project being conducted through the University of Queensland and the Queensland Department of Primary Industries (QDPI). Vertebrae from Tiger Sharks caught in the SMP have contributed to an investigation into the age and growth of Tiger Sharks for eastern Australia (Holmes *et al.* 2015). The specialist fish ageing facilities of DPI have been pivotal in this study. Samples from NSW have contributed to an understanding of the population structure and connectivity of Tiger Sharks across the Indo-Pacific Ocean basin (Holmes *et al.,* 2017). The DPI research project investigating the ecology and movements of Bull Sharks in NSW has recently published on the patterns of occurrence of sharks in Sydney Harbour (Smoothey *et al.*, 2016) and forged strong links with researchers from Griffith University, James Cook University and QDPI, leading to one published manuscript (Heupel *et al.,* 2015) and several international conference presentations. A second manuscript is in preparation investigating seasonal linkages of Bull Sharks using network analysis of telemetry data (Esponiza *et al.,* in prep). Research projects investigating Whaler (Dusky, Spinner and Blacktip) Sharks in NSW and Queensland waters are ongoing with collaborations via Macquarie University, James Cook University, Southern Cross University, Carleton University (Canada), New England Aquarium, and QDPI (Geraghty *et al,.* 2013; Geraghty *et al,.* 2014: Barnes *et al.*, 2016; Butcher *et al.,* 2016; Pleizer *et al.*, 2015). A study investigating age, growth and movements of Shortfin Mako sharks was completed in 2014/15 through collaboration with UTS, CSIRO and SARDI (Kanyasi 2014).

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

3.1.2: Distribution, abundance, biology and ecology of non-target species affected by the SMP.

Although non-target species have not formed the focus of DPI research efforts to date, research into Wobbegong Shark distribution, ecology and movements has been conducted in collaboration with Macquarie University, Sydney Aquarium and NSW OEH. Two Wobbegong Shark collaborative manuscripts were published in 2014/15 (Lee *et al*. 2014; Lee *et al*. 2015).

The reduced number of shark sightings in the SLSNSW database for the current reporting period (2016/17) reflects a change in Research that has been initiated through University of Newcastle investigating Smooth Hammerhead (*Sphyrna zygaena*) biology andfishery interactions as this species represents one of the greatest shark catch species in the SMP. The catch data were presented at the scientific conference 'Sharks International', held in South Africa in 2014. An M.Phil dissertation has been submitted and chapters are being prepared for publication.

Dusky Shark tissue samples from the NSW SMP have been included in genetic research into the effective population size of dusky sharks as part of NSW DPI investigations into the NSW large shark commercial fishery through support of the FRDC on behalf of the Australian Government.

Research into the fishery, biology and ecology of Australian Angelsharks through Macquarie University has provided new information for Australian Angelsharks in NSW that will be of direct relevance to the SMP (Raoult *et al*. 2016: doi. 10.1071/MF15369).

The DPI Shark Scientist has been involved in advising on some Macquarie University cetacean research initiatives and, in collaboration with Macquarie University and OEH, has been involved in research into the efficacy of whale alarms on shark nets (Harcourt *et al.* 2014; Pirotta *et al.* 2016). As an international expert on acoustic dolphin deterrents (ADDs) popularly known as 'pingers' and member of the international World Wildlife Fund (WWF) Cetacean Bycatch Task Force, the DPI Shark Scientist has assisted in reviewing the efficacy of pingers in reducing dolphin bycatch in the South African shark nets in collaboration with the KwaZulu-Natal Sharks Board. The results of this work have been reviewed with respect to implications for the SMP leading to the deployment of alternative (70kHz) pingers in the NSW shark nets. These 'new' pingers have recently been designed to be more targeted to the hearing range of dolphins, rather than the historically available 10kHz pingers that were originally designed for porpoises. Additionally, the DPI Shark Scientist has assisted in trials of an alternative active acoustic device, the DDD pinger, in the experimental shark nets off the NSW far north coast. Results from these trials will be assessed for potential transfer to the SMP.

Level 3 Establish/support collaborative research (e.g. CSIRO, other government agencies and universities)	
3.2 Establish DNA library of shark species taken in the SMP to improve accuracy of identification.	Status: **Ongoing** **3.2.1: *Conduct collaborative research with relevant research institutions.*** An analysis of historical DNA samples taken from sharks caught in the SMP has been completed in collaboration with Macquarie University in 2010. Since then, DNA samples from sharks caught in the SMP have being incorporated in studies investigating east coast stock structure of various whaler sharks in collaboration with the University of Adelaide, Macquarie University, University of Queensland, and James Cook University. Enquiries to assess Smooth Hammerhead Shark stock structure have been made by UQ and UNIFESP (Brazil). Collaboration has been initiated with UTAS and JCU to conduct genetic analysis of Seven-gill Sharks. **3.2.2: *Develop SMP DNA library.*** A shark DNA library incorporating material from the SMP has been developed by DPI and currently contains over 800 samples. Accessioning of new material from the SMP is ongoing. Through collection of genetic data the Australian Blacktip Shark (*Carcharhinus tilstoni*) which was previously not known from NSW waters (Boomer *et al.,* 2010) was identified in the SMP catch. Samples from the SMP have contributed to genetic population analyses of Spinner Sharks (*C. brevipinna*) (Geraghty *et al.,* 2013), plus Dusky (*C. obscurus*) and Sandbar (*C. plumbeus*) Sharks (Geraghty *et al*., 2014), and Shortfin Mako Sharks. In collaboration with UQ scientists, SMP-sourced genetic samples from Dusky, Sandbar, Common Blacktip (*C. limbatus*) and Spinner Sharks are now being used to develop new genetic tools to determine the effective population sizes for these species. Tiger Shark genetic samples have contributed to a recent assessment of population structure and connectivity for this species (Holmes *et al*., 2017). White Shark samples have been incorporated in an analysis of the east coast population by CSIRO (submitted).
3.3 Conduct scientifically-based shark attack risk assessment.	Status: **Ongoing** ***3.3.1: Compile data from research relating to identified high-risk elements.*** Data are 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. It is anticipated that further research in this area will be initiated in due course. ***3.3.2: Apply standard risk assessment model (i.e. AS/NZ:4360).*** Discussions were held with APOLA representatives from NSW to adopt a similar risk assessment process as developed to assist Lake Macquarie City Council lifeguards in managing procedures for suspected and confirmed shark sightings. Ongoing data collection on abundance, distribution and movements of potentially dangerous sharks are being collected for use in the development of future risk assessment 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.
3.4 Conduct morphometrics on sharks and other species caught in the SMP.	Status**: Ongoing** ***3.4.1: Identify need for morphometrics in meeting the needs of the SMP.*** Quality morphometric data is needed to understand the efficacy of the shark nets in reducing interactions with potentially dangerous sharks. Also, the data provides information on the size classes and any possible size-based stock structuring of sharks off NSW. Morphometric data are included in ongoing assessments of shark bite to determine species and size of shark involved in the interaction, and contribute to data collected during research activities linked to the management of NSW commercial shark fisheries. ***3.4.2: Include in research priorities document (1.1) if considered appropriate.*** All research priorities are detailed in the Strategic Research and Monitoring Plan.

Table 5 SMP Monitoring Program – Outcomes for 2016/17.

<table>
<tr><th colspan="2">SMP Monitoring Program – Outcomes for 2016/17</th></tr>
<tr><td>1. Shark Meshing Contractor Catch Report</td><td>All contractors provided weekly reports of catches by telephone or were called each Friday to obtain the report.</td></tr>
<tr><td>2. Shark Meshing DPI Catch Summary Report</td><td>Monthly catch summary reports were submitted to the Fisheries Scientific Committee, the NSW Scientific Committee and OEH (Appendix 1)</td></tr>
<tr><td>3. Tagging program.</td><td>The tagging program continued in 2016/17. A total of 162 (43%) animals were released alive from the nets, 31 of these were sharks comprised of: 8 White Sharks; 11 Greynurse Sharks; 2 Bull Sharks; 5 Dusky Whalers; 2 Bronze Whalers; and 2 Tiger Sharks. As per protocols, the Greynurse Sharks were not tagged. No marine turtles were tagged in 2016/17. For further details refer to Appendix 1.</td></tr>
<tr><td>4. Routine DNA sampling and verification.</td><td>Routine DNA sampling of all dead animals was undertaken in 2016/17. This included 153 genetic samples of which 28 comprised collection of the entire animal (for further details refer to monitoring parameter 5 below and Table 7).
Sampling DNA from live sharks was not undertaken in 2016/17.
Genetic samples for hammerhead sharks caught in the SMP have been submitted for species verification during 2016/17. Results will be compared with the photographic identification used in the current database to determine accuracy of the catch record through photo-identification of sharks caught in the SMP.</td></tr>
<tr><td>5. Shark vertebral and other tissue samples. Historically no samples have been taken from Skates and Rays</td><td>Biological samples were taken from 153 (all dead) of the 211 animals deceased in the 2016/17 season, and are listed below:
<table>
<tr><th>Common Name</th><th>Sample Type and Number</th><th>Total Number Dead</th></tr>
<tr><td>Broadnose Sevengill Shark</td><td>Genetics & vertebrae = 5</td><td>5</td></tr>
<tr><td>Bronze Whaler</td><td>Genetics & vertebrae = 6</td><td>6</td></tr>
<tr><td>Common Blacktip</td><td>Genetics & vertebrae = 9</td><td>10</td></tr>
<tr><td>Dusky Whaler</td><td>Genetics & vertebrae = 8</td><td>9</td></tr>
<tr><td>Greynurse Shark</td><td>Whole = 6</td><td>6</td></tr>
<tr><td>Shortfin Mako</td><td>Genetics & vertebrae = 12; Whole = 1</td><td>15</td></tr>
<tr><td>Smooth Hammerhead</td><td>Genetics & vertebrae = 68</td><td>71</td></tr>
<tr><td>Great Hammerhead</td><td>Whole = 1</td><td>1</td></tr>
<tr><td>Spinner Shark</td><td>Genetics & vertebrae = 9</td><td>10</td></tr>
<tr><td>Silky Shark</td><td>Genetics & vertebrae = 3</td><td>3</td></tr>
<tr><td>White Shark</td><td>Genetics & vertebrae = 3 ; Whole = 11</td><td>14</td></tr>
<tr><td>Thresher Shark</td><td>Genetics & vertebrae = 1</td><td>1</td></tr>
<tr><td>Indo-Pacific Bottlenose Dolphin</td><td>Whole = 1</td><td>2</td></tr>
<tr><td>Green Turtle</td><td>Whole = 3</td><td>4</td></tr>
<tr><td>Common Dolphin</td><td>Whole = 2</td><td>2</td></tr>
<tr><td>Hawksbill Turtle</td><td>Whole = 2</td><td>2</td></tr>
<tr><td>Scalloped Hammerhead</td><td>Whole = 1</td><td>1</td></tr>
<tr><td>Tiger Shark</td><td>Genetics & vertebrae = 1</td><td>1</td></tr>
</table>
</td></tr>
</table>

6. Monitoring of all shark attacks.	When an attack occurs in NSW the DPI Shark Scientist or delegate interviews the victims where they are willing and seeks as much information and evidence of shark identification as can be attained. This includes scale-bar photography of wounds requested from surgeons, examination of wounds and damage to surf craft or clothing/diving materials that show evidence of bite marks and collection of any tooth fragments for analysis to help determine shark species. The DPI Shark Scientist also provides key media support following shark attacks in NSW providing balanced information to the community on the reasonable level of threat. There were no shark-inflicted fatalities or serious injuries during the past year in NSW waters. A total of 12 shark attacks were reported and investigated in NSW waters during the 2016/17 financial year. Four of these interactions were identified to be with a White Shark, while one was determined to be 'likely' from a White Shark. One interaction was determined to be with a Wobbegong Shark and one with a Greynurse Shark. For the remaining five interactions the shark species could not be verified due to insufficient forensic material available. One of these was recorded within the SMP region during winter whilst nets were not in place.
7. Monitor technological advances in shark control measures.	Following the initiation of the $16 Million Shark management Strategy, several studies have been unddertaken to investigate alternative measures to mitigate against shark bite. As the SMP is an 'area-based' methodology, only initiatives addressing area-protection will be discussed in this Annual Report. A project investigating the efficacy of sonar technology to detect and accurately assess potential shark threat (based on size of the shark) was completed by NSW DPI and the University of Technology, Sydney, during 2016/17. Results have not been released at the time of finalisation of this report. Several experiments and trials using Unmanned Aerial Vehicles (popularly known as 'drones') have been conducted by NSW DPI and Southern Cross University. Preliminary results indicate that this technology may provide aerial support suitable for detection of sharks in clear waters. A review of the potential for UAVs to conduct marine fauna surveys has been published as part of this research (Colefax *et al.,* 2017. doi:10.1093/icesjms/fsx100). Drumlines have been used in shark management strategies in Queensland and South Africa for many decades (Cliff and Dudley, 2011; Sumpton *et al.,* 2011). Although these passively fishing baited hooks are more selective and reduce moralities of bycatch, they still impact several species particularly threatened or protected species (Sumpton *et al.,* 2010). A new improvement to classical drumlines that incorporates a real-time catch alert system using satellite communication has been invented in Reunion Island, with the aim of increasing chances of survival of catch (Perry *et al.,* 2014). These new SMART Drumlines have been trialed in NSW. To date, all three target shark species have been caught and successfully tagged and released, with the only byctch during operational deployment on the NSW Far North Coast being two Greynurse Sharks that were alive and released. Survivorship has been exceptionally high as all White Sharks released have subsequently been detected through telemetry, with one White Shark dying during capture (after entangling itself in the gear) and one individual found dead on a beach several days after being tagged and released; a necropsy did not provide any indications of the cause of death..
8. Patterns of movements of non-target marine animals.	DPI has continued working with relevant agencies and reviewed available information during 2016/17 and is not aware of any new information that would necessitate any changes to the SMP.
9. Population trends and patterns of movements of dangerous sharks and attack behaviour.	DPI has sourced information from relevant agencies during 2016/17 and is continuing collaborative research into trends and patterns of movements of dangerous sharks (refer to Table 4 section 2.3). Information available to date does not necessitate any changes to the SMP.

10. Patterns of recreational water contact activities in marine waters.	DPI has reviewed the information that is available from relevant agencies for 2016/17 (refer to Table 4 section 2.4). DPI also collected some data on recreational water contact activities at SMP beaches during aerial surveys conducted during 2016/17. Information collected to date does not necessitate any changes to the SMP.
11. Threatened Species recovery plan reviews.	No new threatened species recovery plans were reviewed in 2016/17 and DPI is not aware of any new information that would necessitate any changes to the SMP.
12. Contractor compliance.	Non-compliance issues during the meshing season related to three contractors, which resulted in the issuing of 1 formal warning. All non-compliance issues in 2016/17 were resolved to the satisfaction of the Shark Meshing Supervisor (for further details refer to section 1.3 Compliance Plan).
13. Monitor net locations by GPS.	GPS location of nets was completed during the 2016/17 meshing season and all nets were in similar positions to those reported in previous years.
14. Shark Meshing Program Annual Performance Evaluation.	The 2016/17 Annual Performance Report provides an evaluation of the performance of the SMP under the Management Plan. No modifications to the SMP are recommended.

1.5 Performance Indicators

Performance indicators and trigger points from the Management Plan are assessed below to determine the extent to which the SMP met its four objectives in 2016/17.

1.5.1 Objective 1 - Reduce the risk to humans from shark attack at beaches of the SMP

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

The trigger point was not tripped during the 2016/17 season (Table 6).

Table 6: Shark interactions with humans in the SMP Region 2008/09 to 2016/17

Meshing Period	Fatal	Serious	Minor	No injury	Total Fatal / Serious	Total interactions in SMP region
2008-09 (pre-JMA)	0	3	0	0	3	3
2009-10	0	0	2	0	0	2
2010-11	0	0	0	0	0	0
2011-12	0	1	2	1	1	4
2012-13	0	0	0	1	0	1
2013-14	0	0	1	0	0	1
2014-15	0	0	3	0	0	3
2015-16	0	0	2	2	0	4
2016-17	0	0	0	1	0	1

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.

A total of 12 shark attacks were reported and investigated in NSW waters during the 2016/17 financial year. None of these resulted in a fatality or serious injuries. One of the shark interactions was recorded within the SMP region and at a netted beach; however, this interaction occurred during winter when the nets are removed. This interaction occurred when the surfer was bumped from his board by what looked like a shark. No injuries or damage to his surfboard were sustained. As a result, the shark species involved could not be verified.

1.5.2 Objective 2 - Minimise the impact on non-target and threatened species.

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

Catch records indicate that 373 animals were reported entangled in the nets during the period from 1 September 2016 to 1 May 2017 (Table 7), and that 301 (81%) were threatened, protected and/or non-target animals (Tables 7 and 8).

Fifty-six (15%) of those 373 interactions were with threatened or protected species, including:

- 22 White Sharks (14 dead; 8 released alive);
- 17 Greynurse Sharks (6 dead; 11 released alive);
- 1 Great Hammerhead (dead)
- 1 Scalloped Hammerhead (dead)
- 6 Green Turtles (4 dead, 2 released alive);
- 2 Hawksbill Turtles (dead);

- 1 Loggerhead Turtle (released alive);
- 1 Leatherback Sea Turtle (released alive);
- 2 Common Dolphins (dead);
- 2 Indo-Pacific Bottlenose Dolphins (dead);
- 1 Australian Fur Seal (released alive)

In addition, there were 245 interactions with other non-target species, including:

- 165 Rays (45 dead, 120 released alive)
- 71 Smooth Hammerheads (dead);
- 5 Angel Sharks (1 dead; 4 released alive);
- 1 Thresher Shark (dead);
- 2 Port Jackson Sharks (released alive);
- 1 Finfish (dead)

Batoids (rays and skates) continue to comprise the greatest proportion of interactions with the SMP at 44%, followed by the collective group of target sharks (Broadnose Sevengill Shark, whalers, Bull Shark, White Shark, and Tiger Sharks) at 25%, and Smooth Hammerheads accounted for 19%.

The trigger point for the objective of '*minimising the impact on non-target species and threatened species*' was tripped in 2016/17 for Greynurse Sharks, Hawksbill Turtles, and Smooth Hammerheads (Table 8).

A review report for tripped trigger points will be prepared in accordance with clause 8.4 of the JMAs and Part 7 of the Management Plan for the SMP in 2017.

Although not a formal trigger point or performance indicator, an increase in the number of animals released alive (albeit with fate unknown) since the JMAs were implemented in 2009/10 could provide some indication of the effectiveness of the shorter soak times, from 96 to 72 hours. The proportion of animals released alive pre - JMA (5 years before) and post – JMA (8 years after) for some major faunal groups and the total numbers of releases and interactions suggests that since the JMAs were implemented, that there has been a 60% increase in the total number of animals released alive, from 27% to 43%(Table 9). It is important to note, however, that many of these animals are caught in very small numbers and small changes can be reflected in high percentages

Table 7 Total SMP entanglements for the 2016/17 meshing season.

Scientific Name	Common Name	Hunter	Central Coast North	Central Coast South	Sydney North	Sydney Central	Sydney South	Illawarra	Released alive/fate unknown	Dead	Total	% of Total Catch
Target Sharks												
Notorynchus cepedianus	Broadnose Sevengill Shark							6	1	5	**6**	2%
Carcharhinus brachyurus	Bronze Whaler	4		1				3	2	6	**8**	2%
Carcharhinus obscurus	Dusky Whaler		6	3		1	2	2	5	9	**14**	4%
Isurus oxyrinchus	Shortfin Mako			8		2	5		0	15	**15**	4%
Galeocerdo cuvier	Tiger Shark							3	2	1	**3**	1%
Carcharhinus falciformis	Silky Shark		3						0	3	**3**	1%
Carcharhinus brevipinna	Spinner Shark	4			1	1		4	0	10	**10**	3%
Carcharhinus limbatus	Common Blacktip			6	1		1	2	0	10	**10**	3%
Carcharodon carcharias	White Shark	7	4	4	1	1	2	3	8	14	**22**	6%
Carcharhinus leucas	Bull Shark	1		1	1				2	1	**3**	1%
Non-Target Sharks and Rays												
Squatina spp	Angel Shark (unknown species)		1	1					1	1	**2**	1%
Squatina albipunctata	Eastern Angel Shark				3				3	0	**3**	1%
Heterodontus portusjacksoni	Port Jackson Shark		1			1			2	0	**2**	1%
Sphyrna zygaena	Smooth Hammerhead Shark	13	15	20	8	8	2	5	0	71	**71**	19%
Sphyrna mokarran	Great Hammerhead Shark				1				0	1	**1**	0%
Alopias vulpinus	Thresher Shark	1							0	1	**1**	0%
Carcharias taurus	Greynurse Shark	9	1	3	1		1	2	11	6	**17**	5%
Sphyrna lewini	Scalloped Hammerhead Shark			1					0	1	**1**	0%
Manta birostrist	Manta Ray					2			1	1	**2**	1%
Myliobatis australis	Southern Eagle Ray		6	1	9	6	6	13	30	11	**41**	11%
Rhinoptera neglecta	Australian Cownose Ray	27	33	12	5	15	4	11	80	27	**107**	29%
Dasyatis thetidis	Black Stingray							5	4	1	**5**	1%
Torpedo macneilli	Short-tail Torpedo Ray	3							2	1	**3**	1%
Rhina ancylostoma	Shark Ray	1			1				2	0	**2**	1%
Aetobatus ocellatus	Whitespotted Eagle Ray				1				1	0	**1**	0%
	unidentified rays		4						0	4	**4**	1%
Non-Target Marine Mammals, Reptiles and Birds												
Delphinus delphis	Common Dolphin		1	1					0	2	**2**	1%
Tursiops aduncus	Indo-Pacific Bottlenose Dolphin		1					1	0	2	**2**	1%
Arctocephalus pussillus doriferus	Australian Fur-seal			1					1	0	**1**	0%
Chelonia mydas	Green Turtle		1	1		3	1		2	4	**6**	2%
Eretmochelys imbricata	Hawksbill Turtle			1	1				0	2	**2**	1%
Dermochelys coriacea	Leatherback Sea Turtle		1						1	0	**1**	0%
Caretta caretta	Loggerhead Turtle	1							1	0	**1**	0%
Non-Target Finfish												
Thunnus tonggol	Longtail Tuna			1					0	1	**1**	0%
	TOTAL	**71**	**78**	**66**	**34**	**40**	**24**	**60**	**162**	**211**	**373**	**100%**

Table 8 Non-target and threatened species entanglements[1] for 2006/07 to 2016/17 and trigger point analysis for 2016/17.

Scientific Name	Common Name	Preceding 10 years catch data										Current reporting year	Endangered 10 Year Annual Average + 2 Std Devs	Vulnerable 10 Year Annual Average + 3 Std Devs	Other species 2 x 10 Year Annual Avg in 2 consecutive years	Trigger tripped (True/False)
		06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17				
Endangered																
Carcharias taurus	Greynurse Shark	2	2	1	2	3	4	9	4	4	19	17	15.8	-	-	**TRUE**
Sphyrna lewini	Scalloped Hammerhead Shark[2]	0	0	1	0	0	0	1	0	0	0	1	1.0	-	-	FALSE
Dermochelys coriacea	Leatherback Turtle	0	0	0	0	0	0	0	2	0	2	1	2.1	-	-	FALSE
Caretta caretta	Loggerhead Turtle	0	0	0	0	0	0	1	0	0	4	1	3.0	-	-	FALSE
Dugong dugon	Dugong	0	0	0	1	0	0	0	0	0	0	0	0.7	-	-	FALSE
Eudyptula minor	Little Penguin	0	0	0	0	0	0	0	0	0	1	0	0.7			FALSE
Vulnerable																
Sphyrna mokarran	Great Hammerhead Shark	0	0	0	0	0	0	0	0	0	1	1	-	1.0	-	FALSE
Carcharodon carcharias	White Shark	11	7	8	5	6	15	3	6	10	31	22	-	34.4	-	FALSE
Chelonia mydas	Green Turtle	0	0	0	0	5	1	0	10	4	13	6	-	17.5	-	FALSE
Megaptera novaeangliae	Humpback Whale	0	0	0	0	0	0	2	1	0	0	0	-	2.3	-	FALSE
Pinnipedia	Seals	1	2	1	1	0	0	0	0	0	0	1	-	2.6	-	FALSE
Procellariidae	Shearwater	0	0	0	0	0	0	0	0	0	1	0		1.0		FALSE
Other Protected or Non-Target Species																
Pseudorca crassidens	False Killer Whale	0	0	0	0	0	0	0	0	0	0	0	-	-	0.0	FALSE
Balaenoptera acutorostrata	Minke Whale	0	0	0	0	0	0	0	0	0	0	0	-	-	0.0	FALSE
Tursiops aduncus	Indo-Pacific Bottlenose Dolphin	2	2	0	1	2	0	0	1	0	9	2	-	-	3.4	FALSE
Delphinus delphis	Common Dolphin	2	1	3	1	0	0	0	4	3	4	2	-	-	3.6	FALSE
Squatina spp	Angelshark species	10	16	12	12	19	14	3	6	1	9	5	-	-	20.4	FALSE
Heterodontus portusjacksoni	Port Jackson Shark	4	2	2	6	0	4	4	2	0	2	2	-	-	5.2	FALSE
Sphyrna zygaena	Smooth Hammerhead Shark[2,3]	34	18	13	16	18	36	22	22	42	112	71	-	-	66.6	**TRUE**
Alopias vulpinus	Thresher Shark	2	3	3	7	3	0	0	0	1	2	1	-	-	4.2	FALSE
Eretmochelys imbricate	Hawksbill Turtle	0	0	0	0	0	0	0	0	1	5	2	-	-	1.2	**TRUE**
	Rays - combined	51	46	30	44	60	42	35	90	86	425	165	-	-	181.8	FALSE
	Finfish - combined	0	4	1	0	0	0	0	1	0	6	1	-	-	2.4	FALSE

1: 'entanglements' includes mortalities and animals released alive.

2: There are low levels of confidence in hammerhead species identification prior to implementation of the JMAs in the 2009/10 season.

3: "Smooth Hammerhead" includes unidentified hammerheads.

Table 9 Percentage of major faunal groups released alive from the SMP pre-JMA and post-JMA.

Faunal Group or Species	% released alive pre-JMA (2004-2009)	Meshing seasons post - JMA								% released alive post-JMA (2009-2017)
		09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	
Target sharks*	**5%**	9%	17%	13%	13%	8%	9%	17%	17%	**14%**
White Shark	**11%**	0%	0%	40%	0%	17%	0%	32%	36%	**26%**
Greynurse Shark	**25%**	0%	67%	25%	33%	50%	0%	73%	65%	**53%**
All hammerheads	**0%**	0%	6%	0%	0%	0%	2%	2%	0%	**1%**
Other non-target sharks	**48%**	36%	27%	44%	33%	25%	0%	54%	75%	**39%**
All rays	**62%**	75%	68%	79%	77%	72%	78%	77%	73%	**75%**
All dolphins	**0%**	0%	0%	0%	NC	0%	0%	0%	0%	**0%**
All turtles	**24%**	50%	29%	0%	0%	25%	33%	21%	40%	**27%**
Released/Interactions	**223/826**	**44/120**	**59/157**	**56/158**	**34/108**	**76/191**	**73/189**	**385/749**	**162/373**	**889/2045**
Total % released alive	**27%**	**37%**	**38%**	**35%**	**31%**	**40%**	**39%**	**51%**	**43%**	**43%**

* 'Target sharks' normally includes White Sharks, but as a threatened species they are separated for the purpose of this analysis.

NC = none caught that year

1.5.3 Objective 3 - Minimise OHS risks associated with implementing the SMP.

The trigger point for this objective is: *one major or minor OHS incident*.

A major incident is one that results in five or more compensable days off work, and a minor incident is one that results in less than five days off work.

The trigger point was not tripped during the 2016/17 season, as there were no OHS incidents.

1.5.4 Objective 4 - Transparent monitoring and reporting.

The trigger point for this objective is: *Annual performance report submitted to the Minister for Primary Industries, Director-General of NSW DPI, Director-General of Department of Premier and Cabinet, the Scientific Committee and the Fisheries Scientific Committee by 31 July each year*.

The trigger point was not tripped during the 2016/17 season

1.6 Summary of Reviews and Overdue Actions

This section summarises all of the trigger points which have been tripped and the status of any overdue actions since the JMAs and Management Plan came into effect in the 2009-10 meshing season.

2010/11: The 'OHS' trigger point was tripped following a wound to a contractor that required stitches and cessation of work for an afternoon. The review report is contained in the 2010/11 Annual Performance Report;

2011/12: The 'serious injury at a meshed beach' trigger point was tripped following a shark attack on a surfer at Redhead Beach in January 2012. The trigger point review report was incorporated within the 5-year review report of the 2009 JMAs, which was publicly exhibited over February-March 2016 and is available at: http://www.dpi.nsw.gov.au.

2012/13: The 'OHS' trigger point was tripped following two slip and fall incidents that required hospitalisation. The trigger point review report is also within the 5-year review report of the 2009 JMAs.

2013/14: The 'entanglement of threatened species' trigger point was tripped following the entanglement of two Humpback Whales in 2012/13, and another one in 2013/14. The 'transparent monitoring and reporting' trigger point was also tripped as the annual performance report for 2013/14 was not submitted to the relevant parties by 31 July 2014. These trigger point review reports are also within the 5-year review of the 2009 JMAs.

2014/15: The trigger point for the objective of 'minimising the impact on non-target species and threatened species' was tripped twice in 2014/15 following the entanglement of four Green Turtles, after 10 were also caught in the 2013/14 meshing season; and following the entanglement of three Common Dolphins, after four were also caught in the 2013-14 meshing season (Table 9). DPI will prepare the review report for these trigger points in 2017.

2015/16: The 'entanglement of threatened species' trigger point was tripped following the higher levels of entanglement of two threatened species (Common Dolphin and Hawksbill Turtle) during the meshing season. The 'transparent monitoring and reporting' trigger point was also tripped as the annual performance report for 2015/16 was not submitted to the relevant parties by 31 July 2016. The review report for these three trigger points is now available on the DPI website.

2016/17: The trigger point for the objective of 'minimising the impact on non-target species and threatened species' was tripped three times following the entanglement of 17 Greynurse Sharks, two Hawksbill Turtles, and 71 Smooth Hammerhead Sharks. The review report will be prepared for these trigger points in 2017.

2 Changes to the Management Plan

This Annual Performance Report has not identified a need for any amendments to the Management Plan or JMAs.

3 Other Programs Complementing the SMP

3.1 Aerial Surveys

As in previous years, a series of aerial surveys were flown along the coast over the SMP region from Wollongong to Stockton. All surveys were flown by helicopter.

Touchdown Helicopters Pty Ltd were contracted through an open tender process to conduct one flight a week, plus a flight each weekend and public holiday during the start of the shark meshing season (hereafter termed 'spring'), peak holiday period ('summer'), and end of the shark meshing season ('autumn') for two years. The summer 2016/17 surveys were planned for 16 days (i.e. 32 passes over each beach): each weekend and public holiday over the peak summer holiday period and every Wednesday from 21 December 2016 to 28 January 2017. The Spring and Autumn surveys were planned for 9 and 14 days (i.e. 18 and 28 passes over each beach), respectively, on Wednesdays, Saturdays and all public holidays.

All aircraft were required to have a trained observer on board who was to collect data using distance sampling methods. The charter company was required to provide a photographer 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 also record other marine wildlife including shoals of bait fish, dolphins, turtles, rays and whales; where possible, accurately identifying the species of shark from the air.
- Provide accurate GPS location of each sighting, plus the estimated distance and angle from the aircraft.
- Record weather and environmental conditions for each flight, including recording the positions where these may have changed.
- Provide timely and adequate records of sightings to DPI, SLS NSW. and the Australian Professional Ocean Lifeguards Association (APOLA).
- Report all sightings of potentially dangerous situations by mobile phone to the relevant surf lifesaving groups (SLS NSW and APOLA) and DPI contact person.
- Report any sightings of shark meshing contractor vessels or nets out of alignment following storms and heavy seas.

3.1.1 2016/17 Results

In an effort to maximize observer focus on searching during transect, all data were recorded into a dictaphone rather than handwriting onto spreadsheets during the survey flights. Analysis of environmental parameters affecting shark and prey abundance and distribution along the NSW coast will be completed by the RAAP Postdoc position at the Sydney Institute for Marine Science. However, as the SMP Annual Performance Report is focused on assessing the ability of this program to provide bather safety, all shark sightings have been assessed independently.

A total of 50 target sharks were seen during the Spring, Summer and Autumn aerial surveys, of which 86% were during Summer. Five White Sharks were seen with two sightings in each of the Spring and Autumn flights, and only one in Summer. Seventeen Bull Sharks were identified from the air, plus another 17 Whaler Sharks. Additionally, a total of 10 unidentified sharks were seen, plus one Greynurse Shark.

The area with greatest number of sightings was the stretch of beach between Blacksmiths and Redhead, Lake Macquarie, where 63% of all sharks were seen.

Nine of the eleven water evacuations initiated by the helicopter crew were implemented in this region. Three of the unidentified sharks led to water evacuations as a precautionary measure due to the size of the shark and its proximity to water users.

3.1.2 Conclusions

Although these results again highlighted the small number of sightings of target sharks from aircraft within the SMP region, with <one shark per 100 km flown, the clustered nature of the sightings and the number of water evacuations implemented by the helicopter crew would suggest that the aerial surveys have potentially assisted in improved bather safety in the metropolitan regions. Analysis of shark and prey abundance and distribution in relation to biotic and abiotic conditions at the sightings will provide a unique ability to investigate the impact of inter-annual and seasonal variation in environmental conditions on potential risk to bathers due to nearshore shark presence.

3.2 SharkSmart Public Awareness and Education Program

DPI continued ongoing work during 2016/17 on the SharkSmart public awareness and education program including releases of updated versions of the SharkSmart App for iPhone and Android. Further information can be found on the DPI website at:
http://www.dpi.nsw.gov.au/fisheries/info/sharksmart

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Appendix 1 – Monthly catch summaries for the 2016/17 meshing season

Appendix 1 Table 1: Detailed Catch Report - 1 September 2016 to 28 September 2016

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Nobbys	02/09/16	*Torpedo macneilli*	Short-tail Torpedo Ray	Alive & Released	No	No	0.8	?
	Stockton	07/09/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	1.71	F
	Merewether	12/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
	Stockton	12/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
	Merewether	14/09/16	*Carcharhinus brachyurus*	Bronze Whaler	Alive & Released	No	Yes	1.8	F
	Merewether	16/09/16	*Carcharhinus brachyurus*	Bronze Whaler	Dead	Yes	No	1.91	F
	Newcastle	25/09/16	*Carcharias taurus*	Greynurse Shark	Dead	Whole	No	2.72	F
Central Coast North	Lakes	05/09/16	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	2.32	M
	The Entrance	16/09/16	*Squatina spp.*	Angel Shark (species unknown)	Alive & Released	No	No	-	F
	Caves Beach	16/09/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	1.64	F
	Lakes	26/09/16	*Heterodontus portusjacksoni*	Port Jackson Shark	Alive & Released	No	No	0.5	F
Central Coast South	Kilcare	04/09/16	*Carcharhinus brachyurus*	Bronze Whaler	Dead	Yes	No	2.38	M
	Umina	04/09/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.96	F
	Umina	04/09/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.07	F
	Umina	11/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
	Umina	11/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
	North Avoca	14/09/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.81	M
	Copacabana	18/09/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	2.02	M
	Copacabana	28/09/16	*Carcharias taurus*	Greynurse Shark	Dead	Whole	No	1.84	F
Sydney North	Bilgola	04/09/16	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	1.6	F
	Avalon	08/09/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Avalon	24/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	M
	Bilgola	26/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	M
Sydney Central	North Narrabeen	02/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Manly	02/09/16	*Heterodontus portusjacksoni*	Port Jackson Shark	Alive & Released	No	Yes	1.1	F
	Queenscliff	04/09/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	1.56	F
	North Narrabeen	07/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.7	F
	Curl Curl	13/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Curl Curl	13/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Manly	19/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Manly	19/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Manly	19/09/16	*Manta birostris*	Manta Ray	Alive & Released	No	No	3	F
	North Narrabeen	21/09/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Curl Curl	25/09/16	*Manta birostris*	Manta Ray	Dead	No	No	2	F
Sydney South	Wanda	09/09/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.23	M
	Cronulla	26/09/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.44	M
Illawarra	North Wollongong	05/09/16	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Dead	Yes	No	2.05	M

	North Wollongong	05/09/16	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Dead	Yes	No	2.25	M
	North Wollongong	05/09/16	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Dead	Yes	No	2.1	M
	North Wollongong	05/09/16	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Alive & Released	No	Yes	2.27	M
	Thirroul	12/09/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.28	F
	Wattamolla	16/09/16	*Galeocerdo cuvier*	Tiger shark	Dead	Yes	No	2.35	M
	Garie	25/09/16	*Carcharhinus obscurus*	Dusky Whaler	Alive & Released	No	Yes	2.2	M

Appendix 1 Table 2: Detailed Catch Report - 29 September 2016 to 26 October 2016

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	05/10/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.7	F
	Stockton	12/10/16	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.8	F
	Stockton	12/10/16	*Torpedo macneilli*	Short-tail Torpedo Ray	Dead	No	No	0.6	F
	Stockton	12/10/16	*Torpedo macneilli*	Short-tail Torpedo Ray	Alive & Released	No	No	0.7	F
	Stockton	18/10/16	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.6	F
	Stockton	21/10/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	No	2.4	F
	Stockton	25/10/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	2.34	M
	Stockton	25/10/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	2.73	F
	Stockton	25/10/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	1.8	F
	Dixon Park	26/10/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	2.4	M
Central Coast North	Blacksmiths	01/10/16	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	0.57	M
	Soldiers	18/10/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	-	F
	Blacksmiths	18/10/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	2	F
Central Coast South	Umina	30/09/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.85	M
	Avoca	06/10/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.7	M
	Umina	10/10/16	*Squatina* spp.	Angel Shark (species unknown)	Dead and decomposed	No	No	0.86	?
	Copacabana	10/10/16	*Carcharhinus limbatus*	Common Blacktip	Dead	No	No	1.8	?
	Kilcare	10/10/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.15	F
	Terrigal	12/10/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.28	M
	McMasters	18/10/16	*Isurus oxyrinchus*	Shortfin Mako	Dead and decomposed	No	No	-	?
	Avoca	18/10/16	*Isurus oxyrinchus*	Shortfin Mako	Dead and decomposed	No	No	-	?
	Umina	20/10/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.28	F
	Avoca	21/10/16	*Arctocephalus pusillus doriferus*	Australian fur-seal	Alive & Released	No	No	0.5	?
Sydney North	Avalon	02/10/16	*Squatina albipunctata*	Eastern Angel Shark	Alive & Released	No	No	0.8	M
	Avalon	05/10/16	*Squatina albipunctata*	Eastern Angel Shark	Alive & Released	No	No	1	M
	Palm	09/10/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.15	F
	Whale	12/10/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.36	M
Sydney Central	Narrabeen	07/10/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.6	F
	Dee Why	07/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1	F
	Narrabeen	10/10/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.25	F
	North Narrabeen	14/10/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.32	F
Sydney South	Elouera	03/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.1	F
	Cronulla	05/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.18	F

	Maroubra	05/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.3	F
	Maroubra	12/10/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Whole	No	1.94	M
	Coogee	26/10/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	2.14	F
Illawarra	Coledale	30/09/16	*Carcharhinus brachyurus*	Bronze Whaler	Dead	Yes	No	-	F
	Garie	30/09/16	*Carcharhinus brachyurus*	Bronze Whaler	Dead	Yes	No	2.2	F
	Coledale	03/10/16	*Dasyatis thetidis*	Black Stingray	Alive & Released	No	No	1.3	?
	Garie	03/10/16	*Carcharhinus brachyurus*	Bronze Whaler	Dead	Yes	No	2.32	M
	Coledale	03/10/16	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	2.32	F
	Coledale	03/10/16	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	2.29	F
	South Wollongong	12/10/16	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	0.96	M
	Austinmer	17/10/16	*Tursiops aduncus*	Indo-Pacific Bottlenose Dolphin	Dead	No	No	1.75	?
	South Wollongong	21/10/16	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Dead	Yes	No	1.75	F

Appendix 1 Table 3: Detailed Catch Report - 27 October 2016 to 23 November 2016

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	28/10/16	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.5	M
	Stockton	28/10/16	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.3	F
	Stockton	01/11/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	2.6	F
	Stockton	04/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	M
	Stockton	04/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Stockton	04/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Newcastle	11/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.4	?
	Stockton	14/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.4	F
	Stockton	14/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.4	F
	Redhead	18/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
Central Coast North	Caves Beach	01/11/16	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	1.17	F
	Blacksmiths	04/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	1.3	F
	Lakes	07/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.92	F
	Shelly	11/11/16	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	2.56	F
Central Coast South	Avoca	27/10/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	3	F
	Umina	04/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.25	F
	North Avoca	16/11/16	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.41	M
	Kilcare	18/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.95	F
	Umina	18/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.82	F
Sydney North	Bilgola	03/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.81	M
	Palm	18/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.42	F
	Warriewood	22/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1	F
Sydney Central	Manly	31/10/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Manly	31/10/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Harbord	31/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.7	F
	Harbord	31/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.7	F
	Manly	08/11/16	*Myliobatis australis*	Southern Eagle Ray	Dead and decomposed	No	No	1	?

	Curl Curl	11/11/16	*Chelonia mydas*	Green Turtle	Alive & Released	No	No	1.2	F
	Dee Why	11/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.5	F
	Dee Why	14/11/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	2.4	M
	North Narrabeen	21/11/16	*Chelonia mydas*	Green Turtle	Alive & Released	No	No	0.7	?
	North Narrabeen	21/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.7	F
Sydney South	nil catch								
Illawarra	Coledale	28/10/16	*Dasyatis thetidis*	Black Stingray	Alive & Released	No	No	1.3	M
	North Wollongong	31/10/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.2	M
	Thirroul	04/11/16	*Dasyatis thetidis*	Black Stingray	Dead	No	No	0.76	F
	Thirroul	04/11/16	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Dead	Yes	No	1.59	M
	Austinmer	04/11/16	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	2	F
	Thirroul	09/11/16	*Dasyatis thetidis*	Black Stingray	Alive & Released	No	No	1.3	F
	Thirroul	16/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.89	F
	Thirroul	16/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.21	F
	Austinmer	23/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.3	F

Appendix 1 Table 4: Detailed Catch Report - 24 November 2016 to 21 December 2016

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	28/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	M
	Stockton	30/11/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.75	M
	Stockton	30/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.14	M
	Stockton	06/12/16	*Rhina ancylostoma*	Shark Ray	Alive & Released	No	No	1.16	F
	Stockton	06/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	No	No	1.35	F
	Merewether	13/12/16	*Carcharhinus brachyurus*	Bronze Whaler	Dead	Yes	No	2.54	M
	Stockton	14/12/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.55	F
Central Coast North	Blacksmiths	29/11/16	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	2.4	M
	Blacksmiths	29/11/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	2.05	F
	Blacksmiths	20/12/16	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	0.52	F
Central Coast South	Terrigal	24/11/16	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	1.07	F
	Avoca	27/11/16	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	1.8	F
	Umina	27/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.14	M
	North Avoca	27/11/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	1.6	M
	Avoca	27/11/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	1.75	M
	McMasters	30/11/16	*Eretmochelys imbricata*	Hawksbill Turtle	Dead	Whole	No	0.5	M
	Avoca	02/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.44	F
	Avoca	02/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.43	M
	Terrigal	07/12/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.8	M
	McMasters	12/12/16	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.67	M
	Copacabana	12/12/16	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.73	M
	Copacabana	12/12/16	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.9	M
	McMasters	14/12/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.87	M
	Kilcare	16/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.2	F
	Terrigal	19/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.16	F

Sydney North	Palm	28/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.36	M
	Palm	30/11/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.32	F
	Palm	05/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.17	M
	Mona Vale	06/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.1	M
	Mona Vale	10/12/16	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.41	M
	Mona Vale	13/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Bilgola	13/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.1	F
	Palm	19/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.17	M
	Palm	19/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.38	F
	Bilgola	21/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.1	F
Sydney Central	North Narrabeen	07/12/16	*Chelonia mydas*	Green Turtle	Dead	Whole	No	0.6	F
	North Narrabeen	14/12/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.9	F
	Dee Why	19/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1	F
Sydney South	Bronte	25/11/16	*Carcharhinus obscurus*	Dusky Whaler	Dead	No	No	2.4	?
	Bondi	28/11/16	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	-	?
	Bondi	28/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Bondi	30/11/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.04	F
	Bronte	14/12/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.48	F
	Bondi	14/12/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.37	F
	Bronte	19/12/16	*Isurus oxyrinchus*	Shortfin Mako	Dead	Yes	No	1.18	M
Illawarra	Garie	25/11/16	*Carcharias taurus*	Greynurse Shark	Dead	Whole	No	2.44	F
	Coledale	28/11/16	*Dasyatis thetidis*	Black Stingray	Alive & Released	No	No	1.4	F
	Austinmer	28/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.95	F
	Coledale	30/11/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.98	F
	South Wollongong	07/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.4	M
	North Wollongong	07/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.9	F
	Coledale	09/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.96	F
	Austinmer	12/12/16	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	1.82	M
	South Wollongong	16/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.15	F

Appendix 1 Table 5: Detailed Catch Report - 22 December 2016 to 18 January 2017

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Redhead	23/12/16	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.5	F
	Stockton	23/12/16	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.4	F
	Stockton	29/12/16	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	M
	Stockton	29/12/16	*Carcharhinus brachyurus*	Bronze Whaler	Alive & Released	No	No	2.05	F
	Stockton	29/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.88	M
	Stockton	09/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.96	M
	Stockton	13/01/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	1.47	F
Central Coast North	Catherine Hill Bay	24/12/16	*unidentified ray*	unidentified ray	Dead and decomposed	No	No	-	?
	Caves Beach	30/12/16	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.86	M
	Caves Beach	05/01/17	*Carcharhinus falciformis*	Silky Shark	Dead	Yes	No	1.145	F

	Soldiers	17/01/17	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	3.2	F
	The Entrance	17/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.3	M
	Blacksmiths	17/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.15	M
	Blacksmiths	17/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.544	M
	Soldiers	17/01/17	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.25	F
Central Coast South	Kilcare	26/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.1	F
	Copacabana	31/12/16	*Carcharhinus obscurus*	Dusky Whaler	Alive & Released	No	Yes	1.8	M
	Copacabana	09/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.8	F
	Copacabana	09/01/17	*Carcharhinus leucas*	Bull Shark	Alive & Released	No	No	2.8	?
	Copacabana	09/01/17	*Carcharias taurus*	Greynurse Shark	Dead	Whole	No	2.54	M
	North Avoca	09/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.4	M
Sydney North	Mona Vale	27/12/16	*Carcharodon carcharias*	White Shark	Dead	Whole	No	1.9	F
	Bilgola	29/12/16	*Carcharhinus leucas*	Bull Shark	Alive & Released	No	No	2	F
	Mona Vale	11/01/17	*Squatina albipunctata*	Eastern Angel Shark	Alive & Released	No	No	1.14	F
	Bilgola	11/01/17	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Newport	16/01/17	*Eretmochelys imbricata*	Hawksbill Turtle	Dead	Whole	No	0.595	M
	Mona Vale	18/01/17	*Rhina ancylostoma*	Shark Ray	Alive & Released	No	No	1.4	F
Sydney Central	Queenscliff	02/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.9	F
	Curl Curl	04/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.5	M
	North Steyne	09/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.6	M
Sydney South	Bondi	05/01/17	*Carcharodon carcharias*	White Shark	Dead	Yes	No	2.87	F
	Bondi	18/01/17	*Chelonia mydas*	Green Turtle	Dead	Whole	No	0.77	F
Illawarra	Garie	23/12/16	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.3	F
	Garie	11/01/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	1.86	M

Appendix 1 Table 6: Detailed Catch Report - 19 January 2017 to 15 February 2017

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	23/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.05	F
	Stockton	24/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.06	F
	Merewether	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.55	F
	Merewether	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.55	F
	Nobbys	06/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead and decomposed	Yes	No	0.98	M
	Dixon Park	10/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.55	F
	Newcastle	10/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead and decomposed	No	No	0.8	M
	Bar	13/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.55	M
	Stockton	13/02/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	No	No	2.2	F
Central Coast North	Blacksmiths	22/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	1.05	F
	Blacksmiths	22/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	1.12	F
	Shelly	24/01/17	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	1.1	F
	Blacksmiths	27/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.9	M
	Blacksmiths	27/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	1.08	F
	Blacksmiths	27/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.95	M

	Blacksmiths	27/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.19	F
	Caves Beach	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.95	F
	Catherine Hill Bay	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.93	M
	Catherine Hill Bay	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	1.1	M
	Catherine Hill Bay	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.88	M
	Catherine Hill Bay	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.87	M
	Catherine Hill Bay	02/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	1.1	M
	The Entrance	02/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.34	M
	Blacksmiths	03/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.95	M
	Catherine Hill Bay	09/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.95	M
	Caves Beach	09/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.99	M
	Blacksmiths	09/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.88	M
	Soldiers	10/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.98	M
	Catherine Hill Bay	10/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.84	M
	The Entrance	10/02/17	*Delphinus delphis*	Common Dolphin	Dead	Whole	No	1.07	M
	Shelly	13/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.92	M
	Blacksmiths	13/02/17	*unidentified ray*	unidentified ray	Dead and decomposed	No	No	-	?
	Lakes	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.96	M
	Lakes	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.91	M
	Catherine Hill Bay	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.97	M
	Catherine Hill Bay	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.96	M
	Catherine Hill Bay	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.95	M
	Catherine Hill Bay	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.92	M
	Blacksmiths	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.97	M
Central Coast South	Terrigal	20/01/17	*Delphinus delphis*	Common Dolphin	Dead	Whole	No	1.75	M
	Umina	20/01/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.02	M
	Terrigal	30/01/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.94	M
	Umina	03/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	-	F
	Umina	03/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.06	F
	Terrigal	06/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.58	M
	Umina	09/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.85	M
	Umina	10/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead and decomposed	No	No	-	?
Sydney North	Mona Vale	09/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.8	F
	Mona Vale	09/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.7	F
	Palm	15/02/17	*Sphyrna mokarran*	Great Hammerhead	Dead	Whole	No	3.64	M
Sydney Central	Dee Why	09/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.9	M
Sydney South	Cronulla	06/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.7	F
	Bronte	09/02/17	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.89	M
	Bondi	13/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
Illawarra	Garie	30/01/17	*Galeocerdo cuvier*	Tiger shark	Alive & Released	No	Yes	3	F
	Garie	03/02/17	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.2	M
	Wattamolla	06/02/17	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.9	M
	South Wollongong	10/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.92	M
	Wattamolla	10/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.43	F
	Garie	15/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.93	F

Appendix 1 Table 7: Detailed Catch Report – 16 February 2017 to 15 March 2017

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	16/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Dixon Park	17/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.55	F
	Redhead	17/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.65	F
	Stockton	21/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.6	F
	Stockton	21/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.65	M
	Stockton	21/02/17	*Alopias vulpinus*	Thresher Shark	Dead	Yes	No	1.89	F
	Stockton	22/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.65	F
	Stockton	22/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.65	M
	Stockton	22/02/17	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.1	M
	Stockton	24/02/17	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.25	F
	Stockton	24/02/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	2.28	F
	Stockton	24/02/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	2.14	F
	Nobbys	01/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.3	M
	Newcastle	13/03/17	*Carcharhinus leucas*	Bull Shark	Dead	No	No	3.2	F
Central Coast North	Caves Beach	18/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.94	M
	Blacksmiths	18/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.92	M
	Soldiers	20/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.93	M
	Caves Beach	20/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.96	M
	Shelly	20/02/17	*Carcharhinus obscurus*	Dusky Whaler	Alive & Released	No	No	3.5	M
	Blacksmiths	23/02/17	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	0.85	F
	Lakes	23/02/17	*Chelonia mydas*	Green Turtle	Dead	Whole	No	0.61	F
	The Entrance	02/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.15	M
	The Entrance	02/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.23	M
	Shelly	11/03/17	*Carcharhinus obscurus*	Dusky Whaler	Alive & Released	No	No	3	M
	Lakes	11/03/17	*unidentified ray*	unidentified ray	Dead and decomposed	No	No	-	?
	Lakes	11/03/17	*unidentified ray*	unidentified ray	Dead and decomposed	No	No	-	?
	Soldiers	13/03/17	*Carcharodon carcharias*	White Shark	Dead	Yes	No	2.54	M
Central Coast South	Umina	16/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.85	M
	Copacabana	16/02/17	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.825	M
	Copacabana	17/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.95	M
	Terrigal	24/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	-	?
	Umina	24/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead and decomposed	No	No	-	?
	Kilcare	27/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.24	F
	Umina	03/03/17	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	2.62	F
	McMasters	05/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.1	F
	North Avoca	14/03/17	*Sphyrna lewini*	Scalloped Hammerhead	Dead	Whole	No	1.2	F
	Kilcare	14/03/17	*Carcharodon carcharias*	White Shark	Alive & Released	No	Yes	2.2	F
Sydney North	Palm	21/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.8	M
	Newport	02/03/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	1.47	F
	Bilgola	13/03/17	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	1.05	F

Sydney Central	Narrabeen	20/02/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.35	F
	Manly	20/02/17	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	1	M
	Narrabeen	21/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.3	F
	Narrabeen	03/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.8	M
	Dee Why	11/03/17	*Carcharhinus brevipinna*	Spinner Shark	Dead	Yes	No	1.2	F
Sydney South	Bondi	24/02/17	*Carcharias taurus*	Greynurse Shark	Dead	Whole	No	2.2	M
	Maroubra	13/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.7	F
	Maroubra	13/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.8	F
	Elouera	13/03/17	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	3.5	F
Illawarra	South Wollongong	20/02/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.95	M
	Austinmer	13/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.87	M
	Austinmer	13/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.92	M
	South Wollongong	13/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.83	M
	South Wollongong	13/03/17	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	1.15	F
	Austinmer	14/03/17	*Carcharhinus limbatus*	Common Blacktip	Dead	Yes	No	1.66	F

Appendix 1 Table 8: Detailed Catch Report – 16 March 2017 to 12 April 2017

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Newcastle	27/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.89	F
	Stockton	28/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.94	M
	Stockton	30/03/17	*Caretta caretta*	Loggerhead Turtle	Alive & Released	No	No	0.85	F
	Stockton	30/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.79	F
	Stockton	05/04/17	*Carcharias taurus*	Greynurse Shark	Alive & Released	No	No	2.1	F
Central Coast North	Catherine Hill Bay	20/03/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.97	F
	Blacksmiths	20/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.84	M
	Blacksmiths	22/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.12	M
	Shelly	24/03/17	*Carcharhinus falciformis*	Silky Shark	Dead	Yes	No	1.39	F
	Blacksmiths	24/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.185	M
	Caves Beach	28/03/17	*Tursiops aduncus*	Indo-Pacific Bottlenose Dolphin	Dead	Whole	No	2.07	?
	The Entrance	29/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.085	M
	Caves Beach	05/04/17	*Dermochelys coriacea*	Leatherback Sea Turtle	Alive & Released	No	No	-	F
	Shelly	08/04/17	*Carcharhinus falciformis*	Silky Shark	Dead	Yes	No	1.668	F
Central Coast South	Terrigal	20/03/17	*Thunnus tonggol*	Longtail tuna	Dead	No	No	1	?
	Umina	20/03/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.84	F
	Terrigal	21/03/17	*Carcharias taurus*	Greynurse Shark	Dead	Whole	No	2.86	F
	Umina	27/03/17	*Chelonia mydas*	Green Turtle	Dead and decomposed	No	No	0.79	M
Sydney North	Bilgola	20/03/17	*Aetobatus ocellatus*	White Spotted Eagle Ray	Alive & Released	No	No	1.4	F
Sydney Central	Dee Why	27/03/17	*Carcharhinus obscurus*	Dusky Whaler	Dead	Yes	No	1	F
Sydney South	Bondi	24/03/17	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	-	F
Illawarra	Coledale	27/03/17	*Myliobatis australis*	Southern Eagle Ray	Dead	No	No	1.2	F
	Thirroul	05/04/17	*Carcharhinus obscurus*	Dusky Whaler	Alive & Released	No	No	3.5	F
	Garie	05/04/17	*Galeocerdo cuvier*	Tiger shark	Alive & Released	No	Yes	3.2	F

Appendix 1 Table 9: Detailed Catch Report – 13 April 2017 to 1 May 2017

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Merewether	13/04/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.93	M
	Newcastle	21/04/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.86	F
Central Coast North	Lakes	14/04/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.9	F
	Blacksmiths	17/04/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.22	M
	The Entrance	24/04/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	1.11	M
	Blacksmiths	27/04/17	*Sphyrna zygaena*	Smooth Hammerhead	Dead	Yes	No	0.87	M
Central Coast South	nil catch								
Sydney North	nil catch								
Sydney Central	Manly	30/04/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
	Manly	30/04/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.5	F
Sydney South	nil catch								
Illawarra	Thirroul	14/04/17	*Myliobatis australis*	Southern Eagle Ray	Alive & Released	No	No	0.8	F
	Austinmer	24/04/17	*Carcharodon carcharias*	White Shark	Dead	Whole	No	1.66	M
	Garie	29/04/17	*Carcharodon carcharias*	White Shark	Dead and decomposed	Yes	No	2.1	M
	Wattamolla	01/05/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.75	F
	Wattamolla	01/05/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.65	F
	Wattamolla	01/05/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.65	M
	Wattamolla	01/05/17	*Rhinoptera neglecta*	Australian Cownose Ray	Dead	No	No	0.75	M
	Wattamolla	01/05/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.65	M
	Wattamolla	01/05/17	*Rhinoptera neglecta*	Australian Cownose Ray	Alive & Released	No	No	0.75	M