

# **Shark Meshing (Bather Protection) Program 2021/22 Annual Performance Report**

Prepared in accordance with the 2017 Joint Management  
Agreement and associated Management Plan

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## Executive Summary

Between the 2009/10 and 2016/17 meshing seasons, the Shark Meshing (Bather Protection) Program (SMP) operated in accordance with Joint Management Agreements (JMAs) and an associated Management Plan authorised by the *Fisheries Management Act 1994* (FM Act) and the *Threatened Species Conservation Act 1995* (TSC Act).

A new, single JMA under the FM Act was prepared in 2017 and the 2017/18 meshing season marked the beginning of SMP operations under the 2017 JMA. Some of the key changes to the JMA were refined trigger points and defining 'target shark' species as White Shark, Bull Shark and Tiger Sharks for the purposes of the JMA and Management Plan.

The objectives of the JMA are to: minimise the impact of the SMP on threatened and protected species; and ensure that the SMP does not jeopardise the survival or conservation status of threatened species or cause species that are not currently threatened to become threatened.

The JMA and the Management Plan require an Annual Performance Report to be prepared and submitted to the parties to the JMA and relevant Scientific Committees convened under the FM Act and *Biodiversity Conservation Act 2016* (BC Act) by 31 July each year.

A total of 376 marine animals were caught in the SMP during the 2021/22 meshing season, comprised of 51 target sharks and 325 non-target animals. One hundred and forty-two animals (38%) were released alive.

The 51 target sharks comprised 28 White Sharks; 12 Bull Sharks; and 11 Tiger Sharks.

The 325 interactions with non-target animals consisted of:

- 149 non-target sharks, including Grey Nurse Sharks; Great Hammerhead Sharks; Smooth Hammerhead Sharks; an unidentified hammerhead species; a Port Jackson Shark; an unidentified shark species; \*Broadnose Sevengill Sharks; \*Whaler Sharks (Bronze Whalers, Common Blacktip Sharks, Dusky Whalers, Silky Sharks; Spinner Sharks; an unidentified whaler species), and \*Shortfin Mako Sharks; (\* reported as target sharks prior to 2017).
- 130 rays, including Southern Eagle Rays; Australian Cownose Rays; Black Stingrays; White Spotted Eagle Rays; Smooth Stingrays; and a White Spotted Guitarfish.
- 40 marine reptiles comprised of: 19 Green Turtles; 16 Leatherback Turtles; 4 Loggerhead Turtles; and 1 unidentified turtle species.
- 2 marine mammals comprised of: 1 Common Dolphin, and 1 Humpback Whale.
- 4 interactions with finfish (Frigate Mackerel, and Mackerel Tuna).

Eighty-four (22%) of the interactions were with threatened species comprised of: 28 White Sharks; 19 Green Turtles; 16 Leatherback Turtles; 14 Grey Nurse Sharks; 4 Loggerhead Turtles; 2 Great Hammerhead Sharks, and 1 Humpback Whale.

Two (<1%) of the interactions were with protected species comprised of: 1 Common Dolphin, and 1 unidentified turtle species.

The observer program was implemented with observers present on 28% of all net checks (hauls/runs) undertaken by SMP contractors. Observers continued to focus on ensuring collection of biological samples in accordance with the Strategic Research and Monitoring Program. Biological samples were taken from 143 of the 234 animals found dead in the nets in 2021/22.

The trigger point for the objective of '*minimising the impact on non-target species and threatened species*' was tripped in 2021/22 for Green Turtles and Leatherback Turtles.

During the 2021/22 meshing season there was one reported shark-human interaction at a meshed beach of the SMP. A surfer was uninjured when bumped by an unidentified shark at Maroubra Beach in March 2022. No injuries were sustained during this interaction so the trigger point for '*reducing the risk to humans from shark attacks at beaches of the SMP*' was not tripped.

This incident did not trip the trigger point related to '*reducing the risk to humans from shark attacks at beaches of the SMP*' for the 2021/22 reporting period.

During the 2021/22 meshing season, there were also seven verified shark-human interactions at unmeshed beaches along the NSW coastline. Three of these interactions occurred in the SMP region with an ocean swimmer being fatally injured after encountering a White Shark at Little Bay Beach, Randwick in February 2022 (approximately 3.5 km south of the nearest meshed beach at Maroubra); a swimmer sustaining minor injuries after suffering a bite from a wobbegong at Warriewood blowhole, Warriewood in January 2022 (approximately 400m south of the meshed beach at Warriewood), and a spearfisher being uninjured after fending off a White Shark while spearfishing at Magic Point, Maroubra in March 2022 (approximately 1km south of the nearest meshed beach at Maroubra).

There were also three unverified interactions, two in March 2022 and one in April 2022.

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 2021/22.

In 2021/22, DPI met all requirements of the JMA and associated Management Plan.

## Introduction

The Shark Meshing (Bather Protection) Program (SMP) is a public safety measure introduced in 1937 to reduce the risk of shark interactions at the State's most popular public bathing beaches. Surf Life Saving NSW figures indicate that about 4.3 million people visited those beaches in 2021/22. Under the current program, 51 beaches between Wollongong and Newcastle (Table 1, Map 1) are netted by seven contractors using specially designed mesh nets.

The aim of the SMP is to reduce the threat of shark interactions within the area of the SMP whilst minimising impacts on non-target species. The only fatality at a meshed beach occurred over 60 years ago, but the nets are not a guarantee that shark encounters will not occur at meshed beaches. According to the May 2022 update of the Australian Shark Incident Database (ASID, formerly known as the Australian Shark Attack File) thirty-five (35) unprovoked shark encounters have reportedly occurred at netted beaches of the SMP, 12 of which involved target sharks: 11 with White Sharks and one with a Tiger Shark. Other encounters at meshed beaches were with unknown species of sharks (9), Wobbegong Sharks (10), and unidentified Whaler Sharks (4). Although one White Shark bite was fatal and some have caused serious injuries, the shark bite data for the SMP and similar programs in other jurisdictions have reportedly reduced the rate of interactions (Dudley, 1997 – noting that at the time of publication there had only been 14 interactions at NSW netted beaches).

Traditional shark bite mitigation programs such as the SMP invariably affect non-target species, and the SMP is listed as a key threatening process in the *Fisheries Management Act 1994* and the *Biodiversity Conservation Act 2016* as it adversely affects threatened species, populations, or ecological communities, or causes species, populations or ecological communities that are not threatened to become threatened.

The operation and environmental impacts of the SMP were reviewed in 2009, and between 2009/10 and 2016/17 it operated in accordance with Joint Management Agreements (JMAs) and an associated Management Plan authorised under the *Fisheries Management Act 1994* (FM Act) and the *Threatened Species Conservation Act 1995* (repealed by the *Biodiversity Conservation Act 2016*). 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.

The JMAs included provisions for five-yearly reviews, and those reviews gave rise to a single 2017 JMA between the then Minister for Primary Industries and the then Chief Executive of the Office of Environment and Heritage (now the Coordinator General for the Environment and Heritage Group, Department of Planning and Environment) in accordance with section 221W(3) of the FM Act. This Annual Performance Report was prepared in accordance with the 2017 JMA and the 2017 Management Plan for the SMP (<https://www.dpi.nsw.gov.au/fishing/sharks/management/shark-meshing-bather-protection-program>).

The objectives of the JMA 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 JMA, the DPI will:

- only carry out shark meshing in accordance with the JMA 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 JMA as required.

The objectives of the Management Plan are to:

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

**Table 1 The seven regions and 51 beaches of the SMP in 2021/22.**

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	

\* Blacksmiths was historically called Swansea-Blacksmiths



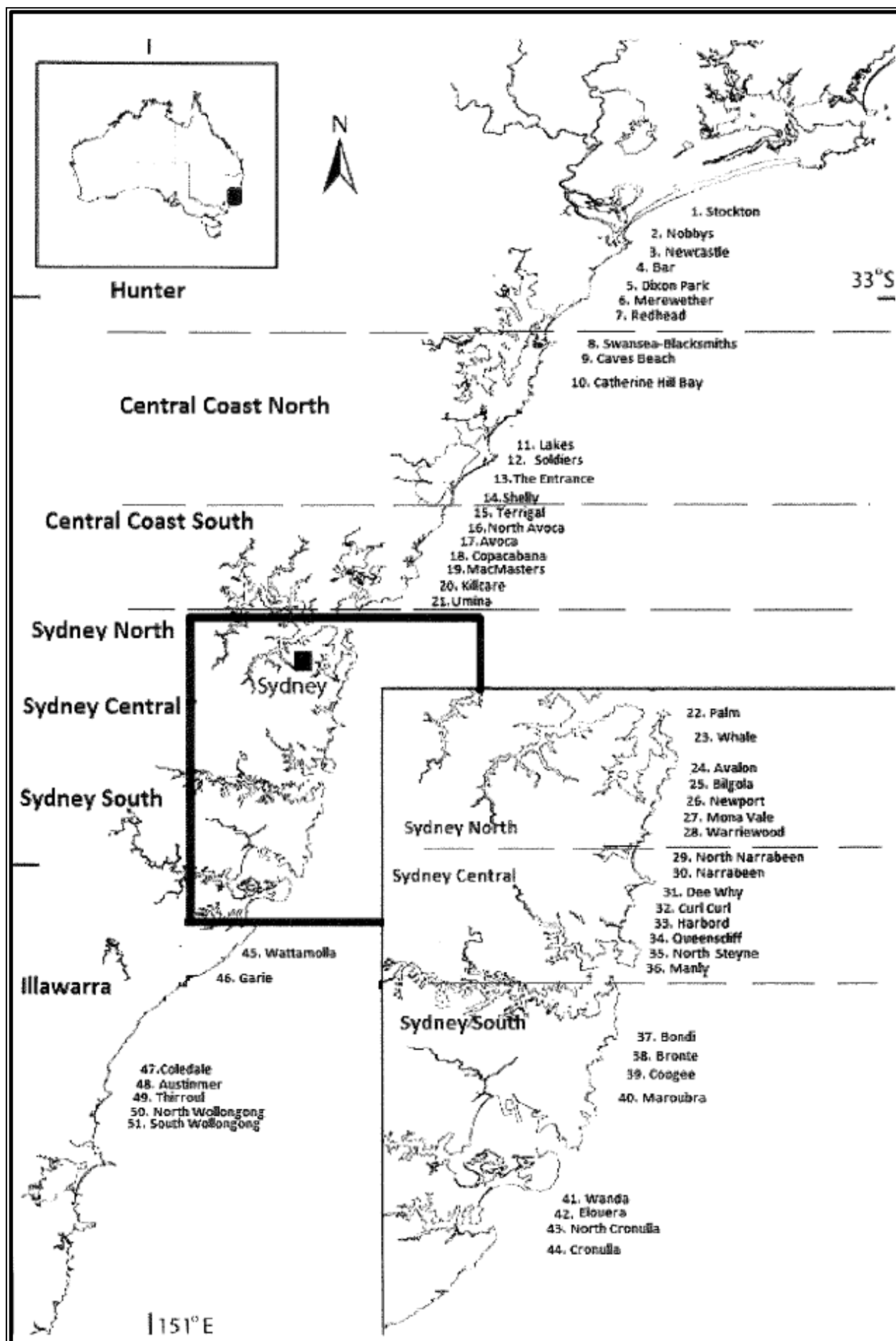


Figure 1 Location of Shark Meshing (Bather Protection) Program beaches.

# 1 SMP Management Plan Performance Assessment

In accordance with the requirements of the JMA 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 JMA. The FSC and SC will advise the Minister for Agriculture and Western NSW and the Coordinator-General – Environment and Heritage Group (EHG), respectively, of any deficiencies in implementation of the JMA by either party. This report and the advice of the FSC and SC are made 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 even, where possible.
- All contractor vessels are required to be equipped with an Automatic Identification System (AIS) whilst undertaking meshing activities. The AIS units are a contractual requirement under the Shark Meshing Program, and live monitoring of vessels is conducted by the DPI Shark Program staff.
- 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.
- Auditing processes are conducted regularly through cross referencing of vessel movement data, contractor catch reports, observer reports, and compliance reports.

The SMP nets are also subject to numerous factors outside the control of the Management Plan such as weather conditions, whale strikes and human interference. The following damaged, vandalised or lost nets were reported during the 2021/22 season.

There were seventeen reports of nets being damaged during the 2021/22 season:

- 5 September 2021, Central Coast South contractor reported that the Avoca beach net had sustained damage. A section of net approx. 2.4m x 2.4m had been torn and it is believed to have been caused by a large animal (shark).
- 10 September 2021, Central Coast South contractor reported Avoca Beach net damage. Large animal (shark) appears to have bitten through the top line.
- 17 September 2021, a yacht became tangled in a Cronulla net and had to be cut free.
- 18 September 2021, Central Coast South contractor reported that the Umina Beach net had a hole in it approx. 3m x 2.4m in size. Suspected interaction with a whale or large shark.
- 30 Sept 2021, Central Coast South contractor reported that the Avoca Beach net had significant damage (approx. 20m); believed to be from a whale. All ropes and mesh were recovered.
- 13 October 2021, Sydney South contractor reported that the Bronte net had suffered a large amount of damage from a suspected whale interaction. All ropes and mesh were

recovered.

- 15 October 2021, Central Coast contractor reported a significant hole found in the Avoca Beach net possibly caused by a large shark.
- 16 October 2021, Mona Vale net cut from top to bottom after Water Police released a shark caught in the net.
- 16 October 2021, Whale Beach net destroyed after whale entanglement requiring the whale to be cut free by NPWS.
- 17 October 2021, Central Coast North contractor reported that the Caves Beach net had been torn in half with approx. 30m of net missing from a suspected whale interaction. The section of net was subsequently found on 19 October 2021.
- 18 October 2021, Sydney South contractor reported that the Wanda net had the top rope cut through by a suspected boat propeller.
- 27 October 2021, the Hunter contractor reported that the net at Bar Beach had 30-40m of mesh torn from a suspected whale interaction. All ropes and mesh were recovered.
- 15 November 2021, Sydney North contractor reported that the Palm Beach net had a large section (approx. 4 - 5m) missing and the mesh was snapped, suspected caused by a large animal. The missing mesh was not recovered.
- 30 January 2022, a yacht was reportedly caught in the Cronulla net and had to cut the float line to free the keel from the net.
- 16 February 2022, Sydney North contractor reported a large tear in the Bilgola net from a suspected large animal interaction.
- 05 March 2022, Sydney North contractor reported damage to Newport, Bilgola, Mona Vale, Avalon and Warriewood nets due to the extreme weather/sea conditions at the time.

\* Contractors report 'suspected whale damage' to nets when it is obvious that the net mesh and/or ropes have been torn, snapped or broken under strain, as opposed to being cut. These reports also coincide with the whale migration season.

There were eight reports of vandalism during the 2021/22 season:

- 2 September – 18 October 2021, Sydney North contractor reported that several whale and dolphins pingers had gone missing from Mona Vale and Warriewood nets.
- 17 September 2021 and 20 September 2021, the Sydney South contractor reported that the net at Coogee beach appeared to have been moved, with both anchors now together. This may have been due to someone moving the net or using it to moor from.
- 27 September 2021, Wattamolla net was damaged with approx. 30ft of net missing. Contractor believes an anchor was ripped through the net
- 30 September 2021, Wattamolla net appears to have been cut in half with one section found wrapped around northern anchor and other section around southern anchor and 5 floats missing.
- 2 October 2021, Sydney South contractor reported that the whale pingers were missing from Bronte net.
- 10 October 2021, Central Coast South contractor reported that the Terrigal net was found floating 500m east (out to sea) from its set location, with its anchors cut off.
- 18 October 2021 – Central Coast South contractor reported Avoca Beach net had approx. 20m of mesh sliced at the southern end of the net.
- 7 November 2021 – Sydney South contractor reported that the Cronulla North net had been cut in half with approx. 20m of mesh and rope missing. Rope and mesh were not recovered.

The extreme and adverse weather conditions throughout the 2021/22 season meant that on several occasions many of the contractors removed one or more of their nets from the water to reduce the chance of losing nets.

There were five reports of nets going missing during the 2021/22 season:

- 05 March 2022 - Sydney South contractor reported that the Maroubra net was missing and possibly submerged on reef at the northern end of the beach. This net was recovered on 12 March 2022.
- 06 March 2022, Illawarra contractor reported that the North Wollongong net had shifted and was submerged on reef east of its normal location. The North Wollongong net was recovered 12 March 2022.
- 06 March 2022, Illawarra contractor reported that the Coledale net was missing. A search of the area over the following weeks failed to find the net and it is still missing.
- 07 March 2022, Sydney Central contractor reported that the Manly net was missing, and subsequent searches of the area have failed to find the net.
- 13 March 2022, Hunter contractor reported that Dixon Park net was missing. A search of the area over the next few days failed to find the net. The contractor reported on 18 March that the net had been reportedly found on Dixon Park beach by NSW surf lifesavers and was dragged up next to the surf-club. The contractor attended the surf-club to collect the net, but the net was not found. The net is suspected to have been put into an industrial waste bin, but this is unconfirmed.

## 1.2 Observer Program

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

### *Employment of Observers*

To satisfy the Observer Program requirements, four people were employed as 'observers' for the eight months of the SMP: two observer positions being full-time (one permanent and one full-time temporary); and two employed on a casual basis. The two full-time observers conducted their duties predominantly in the Hunter, Central Coast North and Central Coast South regions, with the two casual observers covering the Sydney North, Sydney Central, Sydney South and Illawarra regions. All observers were restricted to specific regions for approximately 6 weeks at the beginning of the meshing season due to strict Covid-19 restrictions on cross-regional travel. As travel restriction eased the full-time observers were used across all regions as required and when available.

Overall observer coverage was significantly reduced this season due to the above mentioned Covid travel restrictions at the beginning of the season as well as the use of the SMP observers in other areas of the NSW Shark Program. SMP Observers were extensively used in the last two months of the meshing season in direct response to the fatal shark attack at Little Bay Beach in February 2022 and for the construction, dissemination, and deployment of SMART drumline and VR4G tagged shark listening station equipment as part of the 2021/22 NSW Shark Program. Observers also assisted the Shark Scientist with collation of data, dissections, 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 regards to seagoing skills, assisting in the release of entangled animals and performing animal dissections and tissue sampling.

There was no formal training day for observers or contractors for the 2021/22 meshing season due to Covid-19 restrictions on travel and group gatherings. The retention of the four observers (two fulltime and two casual) from the 2020/21 meshing season meant that the observer program already had experienced observers ready to commence at the start of the season.

### Number of Observer Days

Observers were present for 28% of all net inspections by contractors during the 2021/22 season. A breakdown by region of observer coverage is provided in Table 2.

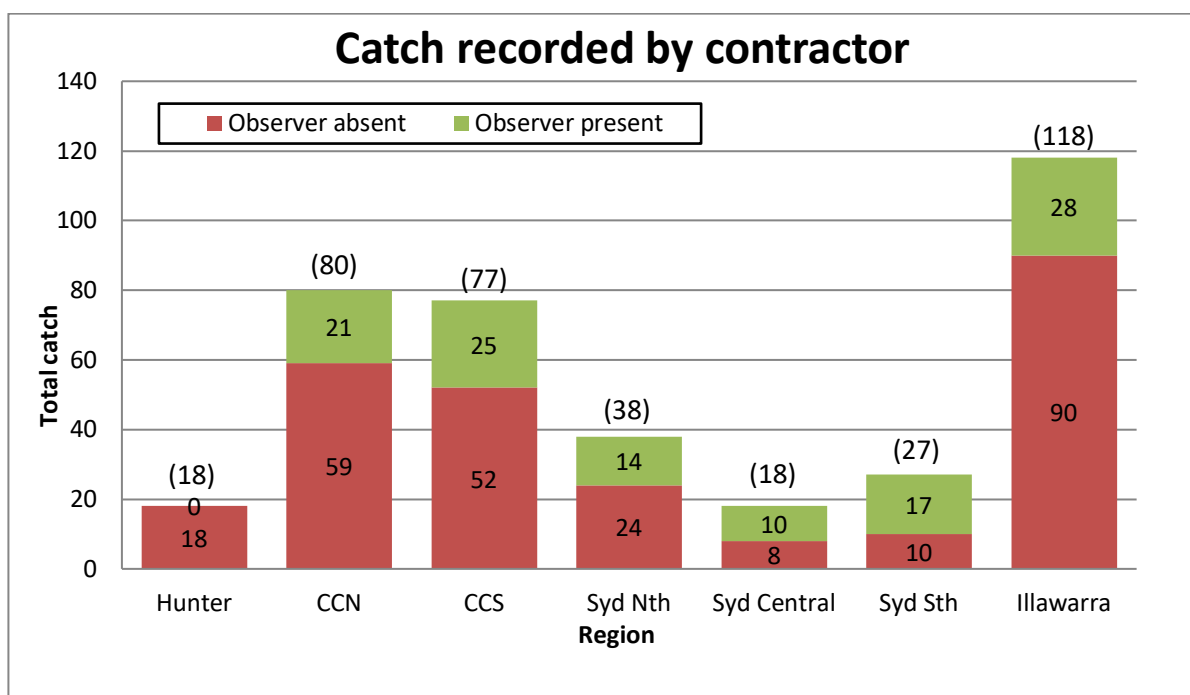
**Table 2 Total net inspections by region during 2021/22 meshing season.**

Meshing Region	Total No. of net Inspections	No. of net inspections with observer present	% of net inspections observed
Hunter	728	133	18%
Central Coast North	729	167	23%
Central Coast South	728	168	23%
Sydney North	738	231	31%
Sydney Central	831	312	38%
Sydney South	831	304	37%
Illawarra	733	170	23%
<b>Total</b>	<b>5318</b>	<b>1485</b>	<b>28%</b>

### Outcomes of Observer Program

Outcomes of the Observer Program for the 2021/22 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 DPI Fisheries).
2. The observers provided accurate details for all witnessed net inspections using iPhones equipped with a customised data recording application. All the data is uploaded and stored in Jotforms. Figure 2 shows the catch numbers recorded by the contractors when an observer was present or absent.
3. Details for all marine mammals and reptiles captured in nets were reported to DPI and DPE-EHG via a monthly report.
4. Collection of 143 biological samples. Only four whole animals were collected during 2021/22 due to a lack of storage space for large animals. Covid restrictions on gatherings over the past two meshing seasons has not allowed for the annual necropsy days to be carried out and subsequently storage freezers are still full. Necropsy days for whole animals retained during the 2019/20, 2020/21, and 2021/22 meshing seasons were completed in July 2022.



**Figure 2 Catch recorded by contractor when observer present or absent during 2021/22.**

### 1.3 Compliance Plan

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

#### Audit and Compliance Checks in 2021/22

Compliance inspections were undertaken prior to and during the 2021/22 meshing season.

- Pre-season net inspections could not be conducted prior to the commencement of the 2021/22 meshing season due to strict Covid-19 travel restrictions. These restrictions meant that experienced staff could not travel across local government areas (LGAs) to conduct these inspections. Checks for size, length and marking of nets were checked while observers were conducting regular onboard duties during the meshing season.
- Fisheries Officers physically inspected mesh nets off 32 of the 51 SMP beaches from offshore patrol vessels or on board the contractor's vessels.
- Fisheries Officers conducted several overt and covert inspections of the contractors' operations throughout the meshing season. Fisheries Officers were encouraged throughout the season to carry out random, thorough inspections of the mesh nets during their routine offshore patrol work. All inspections were recorded on smart devices using a customised data recording application. All the data are uploaded and stored on the Fisheries Compliance Database.

Table 3 displays the number of inspections by Fisheries Officers and pre-season net checks by Shark Meshing Observers per region and whether the outcome was a 'comply' or 'non-comply' for the contracts.

**Table 3 Compliance data by region during 2021/22.**

Region	Pre-season		Meshing season		Inspection Count	% Comply
	comply	non-comply	comply	non-comply		
Hunter	due to Covid travel restriction, experienced staff could not travel across LGA's to conduct preseason net checks		-	-	-	N/A
Central Coast North			5	-	5	100%
Central Coast South			7	-	7	100%
Sydney North			8	-	8	100%
Sydney Central			8	-	8	100%
Sydney South			3	2	5	60%
Illawarra			7	1	8	88%
<b>Total</b>	0	0	38	3	41	<b>93%</b>

Contractors are required to check their set nets every 72 hours weather permitting. This commitment was met on most occasions with 85% of set net inspections taking place within the 72-hour timeframe. The occasions where this requirement was not met, was due to severe weather conditions; and one occasion due to a boat breakdown. 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 was 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 during the season was 100%. The three non-compliance issues recorded by Fisheries Officer's during the meshing season (Table 3) related to nets being bunched up and not stretched out in the water column correctly. Two of these compliance issues were rectified on the day of reporting and the third was rectified within 24 hours.
- The compliance rate for dolphin pinger and whale alarms presence and their placement on nets was 100%.
- The overall compliance rate by contractors was 93% 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 contractors must comply with a range of specifications under the contract outside of routine overt and covert inspections. During the 2021/22 meshing season all contractual requirements were met by all contractors, with no instances of non-compliance detected.

All non-compliance issues in 2021/22 were resolved to the satisfaction of the DPI 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.

- Table 4 provides details of the SRMP research topics and their current status.
- Table 5 provides the outcomes of the SMP Monitoring Program for 2021/22.

Table 4 SRMP 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 funding.	<p>Status: <b>Complete</b></p> <p><i>Activities in 2021/22:</i> SMP research and information needs were included in an overall review of shark hazard mitigation research needs.</p>
Level 2: Data collection and review of existing data	
Level and Topic	Status and Comment
2.1 Review and refine data collection methods	<p>Status: <b>Ongoing.</b></p> <p><b>2.1.1: Review data collection methods used in the SMP.</b></p> <p><i>Activities in 2021/22:</i></p> <p>Following Covid-19 related travel restrictions and inability to collect entire carcasses of species of research interest, enhanced effort was made to collect a variety of data in real-time through implementation of online data forms using the JotForm application for mobile devices. There was no change in species identification methods as onboard photography for species confirmation has proved efficient and effective and is included in the JotForm mobile device app.</p> <p><i>Previous:</i></p> <p>Data collection methods are regularly reviewed and adapted as technology and applicable uses are identified. Following the successful implementation of photographing each animal captured during the 2015/16 SMP season, this technique to confirm species identification continued during the period reported herein.</p> <p><b>2.1.2: Develop refined catch data forms and identification resources.</b></p> <p><i>Activities in 2021/22:</i></p> <p>Catch data forms were transferred to real-time online portal via the mobile application, JotForm. No new relevant species identification resources were identified, so no updates to the contractor and observer materials were implemented.</p> <p><i>Previous:</i></p> <p>Catch data forms and instructions for use were dispensed at the pre-season training days for observers and contractors. New skate and ray, dolphin, sea turtle and Mobulid identification aids were supplied to contractors in 2016/17, 2017/18, 2018/19 and 2019/20, respectively. These identification guides aim to assist in correct identification for the catch records at sea. Weekly catch reporting to the Shark Meshing Program Supervisor continued in the 2020/21 meshing season. The Hammerhead Shark identification guide developed by DPI Fisheries was also incorporated in the species identification guide distributed to all contractors.</p>



**Level 2: Data collection and review of existing data****2.1.3: Identify associated training programs for observers and contractors.***Activities in 2021/22:*

The most important training required for the 2021/22 meshing season for observers and contractors was reiterating tagging procedures for nominated shark species, especially regarding deployment of acoustic tags on the three target shark species and pop-up satellite archival tags (PSATs) on Grey Nurse Sharks. PSATs and acoustic tags were supplied to each contractor to ensure every opportunity of deployment on sharks released alive. The release of 38% of animals alive from the SMP nets highlights the relevance and importance of protocol reviews. Disentanglement procedures for non-target species from DPE-EHG were reviewed, discussed with observers, and passed on to contractors via on-board sessions with the senior shark meshing observer.

**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.***Activities in 2021/22:*

No further review of reported catch using genetic identification was conducted during the period being reported on following the 100% correct identification of various Hammerhead Shark catches in the SMP as reported in the 2017/18 Annual Performance Report.

*Previous:*

General research has continued into molecular forensics for Hammerhead Shark captures in the SMP and led to analyses of species composition and reporting for the 2016/17 SMP season. The 100% correct identification of Hammerhead Shark species was reported on in the 2017/18 Annual Performance Report. Genetic samples are also used for longer term projects and are made available on request to researchers from around the world. The 100% record in correct species identification for Hammerhead Sharks through the use of catch photography to confirm species ID and the ability to obtain good quality photographs and sharing 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.***Activities in 2021/22:*

Travel restrictions related to Covid-19 in NSW precluded the ability to hold the annual pre-season training day. Fortunately, all the observers and five of the seven SMP contractors were ongoing appointments. The new contractors received onboard training from the senior shark scientist and an observer living in the same LGAs as the contractors, thereby conforming with Covid-related travel restrictions in place at the start of the SMP season.

*Previous:*

Training of contractors and observers is designed to improve accuracy of catch identification. The use of the DPI publication '*Identifying Sharks and Rays, A Guide for Commercial Fishers*' is revisited during the annual pre-season training day for observers and contractors to ensure all team members are proficient in identification of species caught in the SMP. Each contractor is provided with an updated copy of the identification book and the purpose-made in-house SMP Marine Species Identification Guide. The latter guide is updated annually (see Section 2.1.2) and incorporates any new information added for groups of species identification and/or research project sampling protocols. Each observer is also issued with an updated version of our SMP Marine Species Identification Guide.

**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.***Activities in 2021/22:*

Seven White Sharks were tagged and released from SMP nets between 1 September 2021 – 30 April 2022. These SMP-released White Sharks will be detected on acoustic listening stations administered through DPI Fisheries and/or the IMOS Animal Tracking Facility.

No new research on White Shark long-term movements off eastern Australia was published during the past year; however, one study examining short-term movements following release from SMART drumlines indicated that White Sharks rapidly move offshore and appear to initiate unihemispheric sleep during circular swimming patterns, potentially as a way to reduce stress related to their capture (Grainger et al., 2021). Video analysis and biologging information indicate that the post-capture recovery period averaged 10 hours (Grainger et al., 2021). These results are likely transferable to White Sharks released alive from the shark nets.

*Previous:*

Historically, the DPI has worked closely with the CSIRO White Shark Project, supplying data from White Sharks caught in the SMP and data of tagged sharks detected on DPI Fisheries arrays of underwater acoustic listening stations. The CSIRO research results showed 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 occur in the Stockton Bight region from mid-August through early January and are in Victoria from January through April (Bruce et al., 2019). Since the start of the NSW Shark Management Strategy in 2015 more than 700 White Sharks have been tagged following capture on SMART drumlines. DPI Fisheries now runs the largest White Shark tagging program in the world. The success of external deployment of acoustic tags by contactors on White Sharks released from the SMART drumlines led to development of similar tags and tagging procedures to implement in the SMP since 2018/19. Data collected via tagged White Sharks indicates that they travel large distances of ~10,000 km per annum and across ocean basins (Spaet et al., 2020b). White Sharks can be found in a large range of water temperatures but appear to optimise in ~20°C (Lee et al., 2021), with abundance and distribution likely linked to ocean-influenced distributions in potential prey (Spaet et al., 2020a). White Sharks are more likely to exhibit area-restricted movement when sea surface temperatures are between 19 and 23°C, with moderate to high surface Chlorophyll- $\alpha$  concentrations and thermal and productivity fronts increasing their likely presence (Lee et al., 2021), with nearshore activity exhibiting predictable patterns of slow (~2.2km.hr<sup>-1</sup>) movement parallel to the shoreline and typically behind the surfbreak (Colefax et al., 2020). Although there is no evidence that White Sharks are 'resident' off NSW beaches, an increased occurrence of juvenile White Sharks within the SMP region has been postulated in response to changes in the East Australian Current (SMP Annual Performance Report 2021).

**2.3.2: Review existing data on other species (e.g. Tiger Shark, Bull Shark).***Activities in 2021/22:*

There have been substantial increases in knowledge on Tiger Sharks occurring in NSW during 2021/22 that would affect the operations of the SMP. Telemetry tracking of Tiger Sharks off the east Australian coast revealed that water temperature change, particularly at higher latitudes, was the most influential environmental factor regulating shark movements (Niella et al. 2021a). This study predicted that the range for Tiger Sharks along the east coast of Australia will extend ~3.5° south by the year 2030, potentially increasing the risk of interactions with humans in nearshore waters within the SMP region. Bites attributed to Tiger Sharks has historically been low in NSW waters (Riley et al. 2022), a factor likely due to low nearshore presence. In fact, Tiger Shark catches in the SMP nets have historically been low (Reid et al, 2011), with probability of catch higher at beaches with deep water closer to the nets (Lee et al. 2018); however, predicted changes in distribution and nearshore abundance of this species could result in future increases in capture. Implementing alternative shark bite mitigation gear, as suggested by Niella et al. (2021b), will have minimal impact on Tiger Shark catch due to the two high catch beaches (Wattamolla and Garie) being too far from suitable launch sites for contractors to respond to

**Level 2: Data collection and review of existing data**

alerts from catches on SMART drumlines.

Target sharks released alive from the SMP are externally tagged with acoustic tags, as per procedures used by SMART drumline contractors in northern NSW, but only three Tiger Sharks were alive, tagged, and released from the shark nets during the 2021/22 season.

During the 8-month reporting period of the SMP, three of the five Tiger Sharks released alive were tagged. More than 200 Tiger Sharks have now been acoustically tagged by DPI as part of the NSW Shark Program (SMP and SMART drumline caught individuals combined). Analysis of movement data from 16 Tiger Sharks equipped with satellite tags indicated that they moved offshore after release from the SMART drumlines and then headed north off the continental shelf (Lipscombe et al., 2020). Although they traversed temperate, sub-tropical and tropical waters, they spent the majority of their time in temperatures between 22°C and 25°C in the upper 50m of the water column (Lipscombe et al., 2020). Recent genetic analyses using historical and contemporary samples has elucidated the potential for two distinct populations of Tiger Shark to have occurred off the eastern coast of Australia (Manuzzi et al., 2022). These authors hypothesize that one population, possibly a nearshore south-eastern Australian eco-type, has all but disappeared and highlight the important role of dedicated sampling programs. Continued collection of biological and genetic samples from Tiger Sharks caught in the SMP, and tagging of animals released alive from the nets, is therefore imperative to elucidate the population structure and ecology of Tiger Sharks occurring in nearshore waters within the SMP region.

No Bull Sharks were tagged during the 2021/22 meshing season (only one released alive), but Bull Shark movement research did continue with individuals being tagged as part of the SMART drumline program. Over 150 Bull Sharks have been acoustically tagged by DPI Fisheries. Analysis of tagged Bull Shark and prey fish movements around Sydney waterways highlighted the importance of rainfall in the catchment. Both teleosts and sharks exhibited varying responses to water flows, with males Bull Sharks responding most promptly to high rainfall by moving upstream within a day, followed by teleost movements between 2-7 days, and female Bull Sharks after 4 days (Niella et al., 2021d). Variability in Bull Shark space use suggested spatial segregation by sex and size. Although individuals target similar prey, they appear to do so in different areas or at different times, enabling them to exploit different resources when in the same habitats (Niella et al., 2021d). Analysis of juvenile Bull Shark use of different habitats within a nursery riverine system, the Clarence River in northern NSW, highlighted the reliance of young sharks on prey associated with salt marshes (Niella et al., 2022). This is a threatened habitat type due to anthropogenic pressures and underscores the potential threat of climate-induced habitat changes to both predators and prey.

Analysis of SMP catch data has corroborated previous conclusions that Bull Sharks can be caught throughout the SMP region and, as a result, only large-scale changes to replace shark nets with alternative gear will reduce potential impact of the shark net catches on this population of sharks (Niella et al., 2021b).

*Previous:*

Previously, there were few studies on Tiger and Bull Sharks that provided new knowledge that would affect the operations of the SMP; however, research conducted over the past year on the population structure, movements and SMP catch characteristics have indicated that ongoing sampling and tagging of sharks caught and released from the nets is imperative to enhance our understanding of potential impacts of these catches, plus the role of climate-induced warming of the East Australian Current on changing the distribution and abundance of these two target species for the SMP.

Historical genetic research including SMP samples, implied that there was no genetic structuring within the Indo-Pacific Ocean basin (Holmes *et al.*, 2017). It was therefore hypothesised that the small annual Tiger Shark catch in the SMP was unlikely to substantially affect the viability of this large homogeneous east Australian population. These results appeared to 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). The apparent preference of Tiger Sharks for deeper waters (Holmes *et al.*, 2017) corroborated analyses indicating Tiger Shark catch increased at localities where shark nets were in close proximity to deep waters (Lee *et al.*, 2018).

Tiger Shark catch rates decreased over the six decades examined in Reid *et al.* (2011), with low annual levels in the recent vicennium precluding robust analysis of potential correlates to catch (Lee *et al.*, 2018).

**Level 2: Data collection and review of existing data**

Similarly, catches of Bull Sharks were historically low and confounded by poor species identification in early years hampering robust analysis of potential correlates to catch (Lee et al., 2018). There has therefore been a reliance on using movements of acoustically tagged Bull Sharks to determine factors that influence their abundance and distribution in NSW coastal waters. Initial research focussed on the Sydney waterways following a serious shark bite in the harbour. Scientific manuscripts detailing patterns of occurrence of sharks in Sydney Harbour have been published (Smoothey *et al.*, 2016; 2019) while larger-scale examination of environmental factors affecting Bull Shark movements and abundance along the south-east coast of Australia are published as Lee et al. (2019). Subsequently, these Sydney-tagged Bull Sharks were included in larger-scale research amalgamating all Bull Sharks tagged along the east coast of Australia.

This collaboration has revealed that Bull Sharks tagged by DPI Fisheries in the Sydney region are travelling beyond Townsville, while Bull Sharks tagged in Queensland are unlikely to travel into the SMP region. This collaboration has resulted in publication of two manuscripts investigating these latitudinal differences in bull shark movements (Heupel *et al.*, 2015; Espinoza *et al.*, 2021). Analyses indicate that movements of Bull Sharks varied according to their tagging location, with sharks tagged in Sydney exhibiting seasonal movements and limited residency times, while 35% of the sharks tagged in the tropics exhibited year-round residency on tropical reefs (Espinoza et al., 2021). Network analyses complemented these findings by revealing different seasonal habitat preferences between regions. Movement patterns of Bull Sharks tagged in Sydney Harbour were driven by seasonal temperature change, while tropical individuals appeared more driven by biological needs such as reproduction. These seasonal movements to and/or from distant bays and estuaries highlights the need for regional conservation approaches, and improved understanding of the degree of connectivity between habitats and latitudes.

Australia-wide acoustic tracking data for 1,491 individuals of seven teleost and seven shark species, including Bull, Tiger and White Sharks, were used to assess stock structure and connectivity and compared to findings from genetic and conventional tagging. Network analysis revealed previously unknown population connections in some species, and in others bolstered support for existing stock discrimination by identifying nodes and routes important to connectivity, e.g., for Bull and White Sharks the network analysis showed movement patterns consistent with previous understanding of stock structure derived using genetic approaches whilst Tiger Sharks show structure within Australian waters, despite genetic evidence indicating panmixia, with individuals not connecting between east and west coasts of Australia (Lédée et al., 2021).

Using SMP and commercial catch data for Bull Sharks, it was determined that increase in occurrence of Bull Sharks over time was associated with seasonal variability of thermal gradients larger than 21°C and westward coastal currents stronger than 0.2 m.s<sup>-1</sup> (Niella et al., 2020). Predictive models using these results overlayed on CSIRO predicted change in oceanographic conditions along the east coast of Australia subsequently indicated that there will be an approximately 1° southward shift in the optimal thermal habitats favourable for year-round Bull Shark occurrence over the next 12 years (Niella et al., 2020). This will lead to a three month increase in the availability of favourable sea surface temperatures along the coast of NSW (i.e. from January-February to December-April) which could have implications for bather safety from shark bite.

This information has subsequently been used in NSW DPI Fact Sheets and SharkSmart outputs, plus television documentaries, to educate public about sharks and shark hazard risks.

**2.3.3: Review existing data on spatial and temporal movements of non-target species.****Activities in 2021/22:**

Helicopter sightings of Australian Cownose Rays (*Rhinoptera neglecta*) were analysed as part of a Master in Research thesis submitted to Macquarie University (Chan, 2021). These rays were more likely to occur along the NSW coast during the warmer months (i.e. spring and summer) with increased sea temperatures supporting larger groups which inevitably swam further from shore. Although Australian Cownose Rays were seen more frequently in the northern half of NSW, group sizes were larger in the southern half and suggest seasonal migration events may be occurring, possibly related to reproduction as female rays caught in the SMP appear to be gravid (Chan, 2021). As the species consistently exhibiting high catch, albeit that 65% are released alive (Table 7), there is cause for concern about the post-release survivorship of these gravid females and the potential impact of shark net catches.

**Level 2: Data collection and review of existing data***Previous:*

The scientific literature on spatial and temporal movements of non-target species is reviewed where possible given available resources. Biological samples from Hammerhead Sharks have recently substantially contributed to knowledge gains for all three species caught in the NSW shark nets. Examination of Great Hammerhead Shark diets highlighted their important link between food webs off eastern Australia (Raoult *et al.*, 2019). The geographic range of Great Hammerhead Sharks was subsequently investigated via stable isotope analysis using these same samples which suggested that this species is not resident off the NSW coast, but rather spends most of its time off Queensland (Raoult *et al.*, 2020). As such, the SMP is unlikely to significantly impact the conservation status of this species, although a watching brief on potential increasing catches with warming oceans through climate change is recommended.

SMP catch data contributed to a National Stock Assessment for Scalloped Hammerhead Sharks (*Sphyrna lewini*) (Saunders *et al.*, 2021). Several analyses and two population structures were modelled to ensure all potential scenarios were accounted for. The results indicate that the biomass of all stocks of Scalloped Hammerhead Shark in Australian waters are considerably higher (less depleted) than previously reported and that the current Total Allowable Catch (TAC - not applicable in NSW where the species is listed as 'endangered' under the *Fisheries Management Act 1994*) for this species is well below the levels required to cause stock declines (Saunders *et al.*, 2021). Notwithstanding these results, Scalloped Hammerhead Sharks has been listed as *Endangered* under the EPBC Act by the Australian Department of Agriculture, Water and the Environment and will therefore affect the SMP.

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 (Wray-Barnes, 2017) and is being prepared for scientific journal publication. This new information will not affect the operation of the SMP.

A PhD on Broadnose Sevengill Sharks (*Notorynchus cepedianus*) was completed through University of Tasmania (Schmidt-Roach, 2018). Acoustic tracking data indicate that both neonate and other life-stages tagged in Port Philip Bay, Victoria, travel to NSW and Tasmania. These results corroborate their genetic findings that there is likely a single population for the south-east coast of Australia. Genetic material collected from the SMP will contribute to publication of these data. These results imply that few catches of this species in the SMP is likely to have minimal impact on the population viability of Broadnose Sevengill Sharks.

Several projects linked to the DPI Fisheries testing of drone technology as an aerial surveillance tool for mitigating shark interactions have led to publications incorporating abundance and distribution of non-target species (Kelaher *et al.*, 2019; Tagliafico *et al.*, 2019), but these studies were not within the SMP region.

**2.4 Review data on shark interactions and beach usage.**

Status: **Ongoing.**

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

DPI Fisheries 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. The Australian Shark Attack File has now been renamed to the Australian Shark Incident Database and will continue to receive NSW DPI shark attack reports to enter in the standardised database (Riley *et al.*, 2022).

**Level 2: Data collection and review of existing data****Number of sharks sighted by Surf Life Saving (SLS) NSW**

Region	Shark sightings									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Hunter	21	33	60	28	8	1	4	18	32	18
Central Coast	12	38	29	24	1	3	0	8	12	20
Sydney	46	46	46	58	8	1	9	25	45	53
Illawarra	3	7	4	7	0	1	0	3	11	13
Total	82	124	139	117	17	6	13	54	100	104

A decline in the number of shark sightings in the SLS NSW database between 2016/17 and 2018/19 reflects a change in the way SLS NSW records shark sightings on patrolled beaches. This was because the number of reported sightings impacted 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, SLS NSW started recording only sightings where a lifesaver or lifeguard was able to confirm the presence of a shark by a second sighting.

The number of shark sightings for the period in this report are similar to the 2020/21 season and reflects the use of drones by SLS NSW to conduct aerial surveillance over patrolled beaches in NSW as part of the three years of trials for this technology. This increase is unlikely to represent an increase in sharks along NSW beaches, but more likely to highlight the value of drone aerial surveillance in detecting sharks (Butcher *et al.*, 2019).

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

From 2006 to 2036 the NSW population is projected to grow by over 2.3 million due to natural increase and net overseas migration, while Sydney's population is projected to grow by 1.7 million people (DECCW, 2009). An increase in beach usage in the area of the SMP is 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 11 years for the regions 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 summer beach visitation within the area of the SMP over the last 11 years averaged approximately 4.8 million people per annum. The drop in beach attendance in 2019/20 and 2021/22 may be related to reduced outdoor activities and travel in the latter months of these periods as a result of government initiatives to reduce the spread of Covid-19, whilst the rebound in beach visitations for the 2020/21 period reflects the success in managing Covid-19 outbreaks in NSW and subsequent abilities for NSW residents and domestic visitors to enjoy our beaches and waterways prior to new restrictions coming into effect at the start of 2022.



**Level 2: Data collection and review of existing data**

Visitations											
Region	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Hunter	286,798	360,549	741,444	690,343	728,803	764,529	729,592	714,965	656,794	619,769	599,050
Central Coast	412,764	1,095,724	1,260,034	1,241,243	1,145,309	1,173,890	736,021	1,182,741	943,798	1,312,599	1,062,130
Sydney	1,783,692	2,483,113	3,488,837	3,897,491	3,681,255	3,743,419	3,526,008	4,679,380	2,970,793	3,255,870	2,455,210
Illawarra	105,273	132,628	304,703	392,447	363,194	380,299	343,473	297,351	252,013	436,677	268,050
<b>Total</b>	<b>2,588,527</b>	<b>4,072,014</b>	<b>5,795,018</b>	<b>6,221,524</b>	<b>5,918,561</b>	<b>6,062,137</b>	<b>5,335,094*</b>	<b>6,874,437</b>	<b>4,823,398</b>	<b>5,624,915</b>	<b>4,384,440</b>

\* Patrol period for 2017-2018 was between the 23 September to 29 April

DPI Fisheries supported research into unmanned aerial vehicle applicability for marine and coastal research has demonstrated that drones are an effective assessment tool to quantify beach users across a range of environmental conditions and thereby improve coastal management decisions (Provost *et al.*, 2019). DPI Fisheries have supported SLS NSW with drones and training of lifesavers and it is envisaged that these will be used for beach management purposes, including beach counts, as well as water safety.

**2.5 Review effectiveness of fishing operations used in shark control programs**

Status: **Ongoing.**

**2.5.1: Review NSW shark meshing net configurations.**

*Activities in 2021/22:*

No new research into net configurations occurred during the period reported; however, eDNA from broken nets was collected to identify the species that broke free from the nets. These samples will be collated and analysed once sufficient samples have been collected to warrant the costs & effort for genetic analysis.

*Previous:*

Analysis of catch trends in the far north coast shark net trials has been completed and published as Broadhurst and Cullis (2020). They conclude that nets should be checked every 72-96 hours to optimise efficiency for target species whilst minimising the absolute mortality of rays. This implies that no changes in the current JMA are required regarding regularity of checking the SMP shark nets. 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., drumlines).**

*Activities in 2021/22:*

The DPI Fisheries senior shark scientist contributed to a review of the NSW DPI Shark Management Strategy (Cardno, 2021) which reviewed all non-lethal alternative systems to shark nets for mitigating unprovoked shark bite on bathers and surfers at ocean beaches.

This review provided eight recommendations, which includes ensuring ongoing assessment of area-based systems to determine their suitability to replacing mesh nets in the Metro region.

*Previous:* refer to the 2020/21 Annual Performance Report

**Level 2: Data collection and review of existing data****2.5.3: Use the outcomes of those reviews to trial gear-related modifications of the SMP.***Activities in 2021/22:*

SMART drumlines were subsequently deployed in April 2022 off eight beaches in the Newcastle region (<https://www.sharksmart.nsw.gov.au/data/assets/image/0006/1393548/Map-SMART-drumlines-Newcastle-web.png>), six beaches in the Lake Macquarie region (<https://www.sharksmart.nsw.gov.au/data/assets/image/0003/1393563/Map-SMART-drumlines-Lake-Macquarie.png>), sixteen beaches in the Central Coast region (<https://www.sharksmart.nsw.gov.au/data/assets/image/0007/1403746/SD-Map-Central-Coast-Nth-Sth.png>), twenty-one beaches in the Sydney Northern Beaches region, eight beaches in the Sydney East region (<https://www.sharksmart.nsw.gov.au/data/assets/image/0008/1393568/Map-SMART-drumlines-Randwick-Waverley.png>), six beaches in the Sutherland region (<https://www.sharksmart.nsw.gov.au/data/assets/image/0007/1393279/Sutherland-web-map.png>), and thirteen beaches in the Wollongong region (<https://www.sharksmart.nsw.gov.au/data/assets/image/0010/1393570/Map-SMART-drumlines-Wollongong.png>).

The NSW Shark Program for 2021/22 continued to support the pilot training and use of drones at beaches patrolled by SLS NSW. Every coastal LGA along the NSW coastline had at least one UAV patrol location, with 50 beaches provided aerial shark surveillance via certified SLS NSW drone operators over the 2021/22 summer holidays.

*Previous:* refer to the 2020/21 Annual Performance Report

**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 2021/22 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
<b>3.1 Research needs identified (e.g. environmental impacts of shark meshing).</b>	<p><b>Status: Ongoing</b></p> <p><b>3.1.1: Distribution, abundance, biology and ecology of target species affected by the SMP.</b></p> <p><i>Activities in 2021/22:</i></p> <p>The University of Sydney PhD on White Shark foraging ecology continued to collect White Shark prey species for nutritional analyses to determine the nutritional landscape of this apex predator to link to their feeding preferences, distributions, and movements. Isotopic analysis of sequential tooth files has suggested individual differences in the consumption of pelagic and benthic mesopredator species; however, a narrow range of nutrient intakes was observed across individuals indicating this species is a potential nutritional specialist (Grainger <i>et al.</i>, 2022). This implies that individual White</p>



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

Sharks may use different prey species as alternate, nutritionally complementary means to satisfy similar nutritional requirements. Ensuring these potentially narrow nutritional requirements are met may regulate the movements of White Sharks to be closely linked to movements of their preferred prey species. As oceanography regulates primary production, and via cascading effects through the food web influences mesopredator abundance and distribution, these results imply that monitoring of sea temperature or chlorophyll levels as an indicator for potential movements of White Sharks into nearshore waters may enable development of predictors for bather safety risk analyses.

Isotopic analysis of Bull Shark diets by a PhD candidate at Macquarie University has indicated that at approximately 2.5 years this species changes their diet from prey feeding on sources derived from particulate organic matter, to prey that relied mostly on salt marsh habitats (Niella *et al.*, 2022). Subsequent analysis of their teeth by a Master in Research candidate at Macquarie University indicates that tooth morphology, reflecting tooth strength and potential prey handling capabilities, changes at the same time that these ontogenetic dietary changes occur (Goodman *et al.*, 2022) and the Bull Sharks start moving into habitats in closer proximity to human activities.

A Sydney University of Technology student, in collaboration with colleagues from the CSIRO, has analysed morphometric data from White Sharks caught in the SMP to develop formulae that will allow calculations of length/length and length/weight conversions for future studies of Australian White Sharks.

*Previous:* refer to the 2020/21 Annual Performance Report

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

*Activities in 2021/22:*

Three whole carcasses of non-target animals caught in the SMP were collected during the 2021/22 period. One deceased Australian Cownose Ray (*Rhinoptera neglecta*) and two Southern Eagle Rays (*Myliobatis australis*) were collected to enable future training of contractors and observers in acoustic tagging of rays as part of a new PhD study through Macquarie University proposed for the 2022/23 season.

No necropsies of marine mammals and sea turtles caught in the SMP were conducted during the 2021/22 SMP season.

No deceased Grey Nurse Sharks were retrieved whole to contribute to the ongoing DPI Fisheries research program on this species.

Five non-target species were tagged during the 2021/22 SMP period (see Table 5)

*Previous:* refer to the 2020/21 Annual Performance Report

**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.**

*Activities in 2021/22:*

No new collaborations for genetic analysis of SMP-collected samples were established during the past year, but genetic samples from all deceased animals were collected to contribute to future collaborations, particularly for priority species to determine stock size & structure.

*Previous:* refer to the 2020/21 Annual Performance Report

**3.2.2: Develop SMP DNA library.**

A shark DNA library incorporating material from the SMP has been developed by DPI Fisheries and currently contains over 1,100 samples. Accessioning of new material from the SMP is ongoing.

For further details, refer to the 2020/21 Annual Performance Report

**Level 3 Establish/support collaborative research (e.g. CSIRO, other government agencies and universities)**
**3.3 Conduct scientifically-based shark attack risk assessment.**

Status: **Ongoing**

**3.3.1: Compile data from research relating to identified high-risk elements.**

*Activities in 2021/22:*

The NSW Shark Management Strategy (SMS) has initiated substantial research effort into better understanding factors influencing shark attacks (<https://www.dpi.nsw.gov.au/fishing/sharks>). Data streams include aerial survey data on marine wildlife abundance and distribution, beach user data, tagged target shark movements (acoustic tags and satellite tags), target shark behavioural studies especially with respect to their foraging, shark behaviour and movements in relation to beached whales. All these studies and data streams are being collected to identify high-risk elements and will be analysed during the life of the SMS. A suite of publications on these topics have been published during the past year (see publications in the supplied list of References). An independent review of the first seven years of the new NSW DPI shark hazard mitigation programs was completed (Cardno, 2021) and is available online.

An analysis of NSW shark attacks is being prepared for publication.

*Previous:*

A review of alternative systems to shark nets was conducted as part of the NSW SMS (Cardno, 2015). This review was subsequently updated for publication in a peer-reviewed scientific journal (McPhee *et al.*, 2021).

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).**

*Activities in 2021/22:*

More data has been collected to assist in this application. An agreement has been reached with an independent company, Risk Frontiers, to use DPI Fisheries data for modelling potential risk to shark attack. This project stalled due to the Covid-19 pandemic; however, the post-doctoral position at Macquarie University will likely start in the second half of 2022.

*Previous:* refer to the 2020/21 Annual Performance Report

**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 assess the efficacy of the shark nets in reducing interactions with target sharks. 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.

All catches are measured, plus a full set of 52 morphometrics recorded for all whole carcasses collected.

**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 2020/21.

SMP Monitoring Program – Outcomes for 2020/21																																						
<b>1. Shark Meshing Contractor Catch Report</b>	All contractors provided daily reports of catches by email and/or telephone and submit a monthly catch data summary sheet with all details of meshing operations and catch during that reporting period.																																					
<b>2. Shark Meshing DPI Catch Summary Report</b>	Monthly catch summary reports were submitted to the Fisheries Scientific Committee, the NSW Scientific Committee and DPIE-EES (Appendix 1)																																					
<b>3. Tagging program</b>	<p>The tagging program continued in 2021/22, with tagging of 18 of the 36 sharks released alive from the SMP nets. Tagged sharks included: 9 White Sharks (7 with acoustic tags); 2 Grey nurse Sharks (1 mini-PSATs &amp; 1 acoustic tag); 3 Tiger Sharks (acoustic tags); 1 Shortfin Mako Shark; 1 Dusky Whaler; 1 Broadnose Sevengill Shark; and 1 Port Jackson Shark. Prior to 2019 DPI Fisheries protocols did not support the tagging of Grey nurse Sharks, however, with the purchase of mini-PSATs the tagging of Grey nurse Sharks commenced in February 2019. Fourteen Grey nurse Sharks released from the shark nets have been tagged with mini-PSATs to date.</p> <p>No marine turtles were tagged in 2021/22. For further details refer to Appendix 1.</p>																																					
<b>4. Routine DNA sampling and verification</b>	<p>Routine DNA sampling of 139 dead animals was undertaken in 2021/22. Only four whole animals were collected during 2021/22 due to a lack of storage space for large animals. Covid restrictions on gatherings over the past two meshing seasons has not allowed for the annual necropsy days to be carried out and subsequently storage freezers are still full. Necropsy days for whole animals retained during the 2019/20, 2020/21, and 2021/22 meshing seasons were completed in July 2022.</p> <p>Sampling DNA from live sharks was not undertaken in 2021/22.</p> <p>Species identification was not genetically verified during 2021/22 following the Australian Museum analysis indicating 100% correct identification of hammerhead sharks (Frankham, 2017). All turtle samples were sent to the Australian Museum on behalf of the NSW National Parks &amp; Wildlife Service.</p>																																					
<b>5. Shark vertebral and other tissue samples. Historically no samples have been taken from Skates and Rays</b>	<p>Biological samples were taken from 143 (all dead) of the 234 animals deceased in the 2021/22 season, and are listed below:</p> <table border="1"> <thead> <tr> <th>Common Name</th><th>Sample Type and Number</th><th>Total Number Dead</th></tr> </thead> <tbody> <tr> <td>Australian Cownose Ray</td><td>Whole = 1</td><td>10</td></tr> <tr> <td>Broadnose Sevengill Shark</td><td>Genetics &amp; vertebrae = 10</td><td>12</td></tr> <tr> <td>Bronze Whaler</td><td>Genetics &amp; vertebrae = 17</td><td>23</td></tr> <tr> <td>Bull Shark</td><td>Genetics &amp; vertebrae = 8, Whole = 1</td><td>11</td></tr> <tr> <td>Common Blacktip</td><td>Genetics &amp; vertebrae = 10</td><td>12</td></tr> <tr> <td>Dusky Whaler</td><td>Genetics &amp; vertebrae = 5</td><td>10</td></tr> <tr> <td>Great Hammerhead</td><td>Genetics &amp; vertebrae = 2</td><td>2</td></tr> <tr> <td>Green Turtle</td><td>Genetics = 10</td><td>14</td></tr> <tr> <td>Grey nurse Shark</td><td>Genetics &amp; vertebrae = 4</td><td>5</td></tr> <tr> <td>Leatherback Turtle</td><td>Genetics = 3</td><td>5</td></tr> <tr> <td>Shortfin Mako</td><td>Genetics &amp; vertebrae = 5</td><td>7</td></tr> </tbody> </table>		Common Name	Sample Type and Number	Total Number Dead	Australian Cownose Ray	Whole = 1	10	Broadnose Sevengill Shark	Genetics & vertebrae = 10	12	Bronze Whaler	Genetics & vertebrae = 17	23	Bull Shark	Genetics & vertebrae = 8, Whole = 1	11	Common Blacktip	Genetics & vertebrae = 10	12	Dusky Whaler	Genetics & vertebrae = 5	10	Great Hammerhead	Genetics & vertebrae = 2	2	Green Turtle	Genetics = 10	14	Grey nurse Shark	Genetics & vertebrae = 4	5	Leatherback Turtle	Genetics = 3	5	Shortfin Mako	Genetics & vertebrae = 5	7
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		Silky Shark	Genetics & vertebrae = 2	4	
		Smooth Hammerhead	Genetics & vertebrae = 36	51	
		Southern Eagle Ray	Genetics & vertebrae = 6, Whole = 2	33	
		Spinner Shark	Genetics & vertebrae = 1	1	
		Tiger Shark	Genetics & vertebrae = 3	6	
		White Shark	Genetics & vertebrae = 16	18	
		Whitespotted Guitarfish	Genetics & vertebrae = 1	1	
<b>6. Monitoring of all shark attacks</b>	<p>When an attack occurs in NSW the DPI Fisheries Shark Scientist or delegate interviews the victims, where they are willing to cooperate, and seeks as much information and evidence of shark identification as can be attained. This includes scale-bar photography of wounds requested from responders/surgeons, examination of wounds and damage to surf craft or clothing/diving materials that show evidence of bite marks and collection of any tooth fragments for analysis to help determine shark species.</p> <p>The Shark Scientist also provides key media support following shark attacks in NSW providing balanced information to the community on the reasonable level of threat.</p> <p>There were two fatalities and two serious injuries due to shark interactions in 2020/21 in NSW waters, and another four instances where surfers suffered minor injuries.</p> <p>A total of 13 shark interactions were reported and investigated in NSW waters during 2021/22. These interactions included: four interactions with White Sharks (Crescent Head (serious), Shelly Beach – Coffs Harbour (fatal), Little Bay Beach - Randwick (fatal), and Magic Point – Maroubra); one with a whaler species (Hyams Beach – Jervis bay); three with Wobbegong Sharks (Parks Beach – Coffs Harbour, Warriewood blowhole – Warriewood, and Crowdy Bay – Crowdy Heads); and one with an unidentified shark species (Maroubra Beach - Maroubra).</p> <p>Four of these interactions occurred within the SMP region of NSW coastline during the eight-month netting season with one occurring at a netted beach (Maroubra Beach) and the other three at non-netted locations (Warriewood Blowhole – Maroubra, Little Bay Beach – Randwick, and Magic Point – Maroubra).</p> <p>There were also four unverified interactions that reportedly resulted in minor or no injuries at Diamond Head, Crowdy Bay, Newcastle, and Fingal Beach.</p>				
<b>7. Monitor technological advances in shark control measures</b>	Reviews of alternative, non-lethal, shark management technologies have been published in a peer-reviewed scientific journal (McPhee <i>et al.</i> , 2021) and online (Cardno, 2021). Monitoring of technological advances in shark control measures is ongoing in this rapidly developing field				
<b>8. Patterns of movements of non-target marine animals</b>	DPI Fisheries continues working with relevant agencies and reviewed available information during 2021/22 and is not aware of any new information that would necessitate any changes to the SMP.				
<b>9. Population trends and patterns of movements of dangerous sharks and attack behaviour</b>	<p>DPI Fisheries has sourced information from relevant agencies during 2021/22 and is continuing collaborative research into trends and patterns of movements of target sharks (refer to Table 4 section 2.3). Information available to date does not necessitate any changes to the SMP.</p> <p>As reported in the 2020/21 Annual Performance Report, the only target species for which a population estimate now exists is the White Shark. Close-kin genetic techniques were used by CSIRO to estimate adult White Shark abundance for the eastern Australasian population to be 750 individuals in 2017 (uncertainty range of 470 to 1,030), and the total population size was estimated at 5,460 individuals (uncertainty range 2,909-12,802) with a high survivorship of approximately 93% (Bruce <i>et al.</i>, 2018). The trend in abundance was not significantly different from zero (i.e., no trend so an apparently stable population where births = deaths, on average). This apparently stable population has been corroborated by Davenport <i>et al.</i> (2020) who used genetic samples of White Sharks to determine that the effective number of breeders in the population was comparable over the four years between 2010 and 2013.</p>				

<b>10. Patterns of recreational water contact activities in marine waters</b>	DPI Fisheries has reviewed the information that is available from relevant agencies for 2021/22 (refer to Table 4 section 2.4). DPI Fisheries collected some data on recreational water contact activities at SMP beaches during UAV aerial surveys conducted by SLSNSW during 2021/22. Information collected to date does not necessitate any changes to the SMP.
<b>11. Threatened species recovery plan reviews</b>	No new recovery plans were prepared in 2021/22 and DPI Fisheries is not aware of any new information that would necessitate any changes to the SMP.
<b>12. Contractor compliance</b>	Three non-compliance issues were reported by Fisheries Officers during the 2021/22 season, and all related to nets being bunched up and not stretch out in the water column correctly. All non-compliance issues in 2021/22 were resolved to the satisfaction of the DPI Shark Meshing Supervisor (for further details refer to section 1.3 Compliance Plan).
<b>13. Monitor net locations by GPS</b>	GPS location of nets was completed at the start of the 2021/22 meshing season with net locations being noted by observers throughout the meshing season. All nets were in similar positions to those reported in previous years.
<b>14. Shark Meshing Program Annual Performance Evaluation.</b>	The 2021/22 Annual Performance Report provides an evaluation of the performance of the SMP under the Management Plan. The JMA and Management Plan are being reviewed in 2022 as per clause 9 of the JMA. Any modifications identified in this review process will be introduced into the SMP during the 2022/23 season.

## 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 2021/22.

### 1.5.1 Objective 1 - reduce the risk to humans from shark bites 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. There was one shark-human interaction at a meshed beach (Maroubra) during the 2021/22 meshing season. A surfer was uninjured when bumped by an unidentified shark in March 2022, so the trigger point was not tripped during 2021/22.

**Table 6 Shark interactions in the SMP Region 2008/09 to 2021/22**

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
2017-18	0	1	1	0	1	2
2018-19	0	0	2	0	0	2
2019-20	0	0	2	2	0	4
2020-21	0	0	0	4	0	4
2021-22	1	0	1	2	1	4

Note: Interaction information was cross-referenced with shark incident log records held by SLS NSW (Surf Life Saving Manager) and the Australian Shark Attack File.

During the 2021/22 meshing season, there were also seven verified shark-human interactions at unmeshed beaches along the NSW coastline. Three of these interactions occurred in the SMP region with an ocean swimmer being fatally injured after encountering a White Shark at Little Bay Beach, Randwick in February 2022 (approximately 3.5 km south of the nearest meshed beach at Maroubra); a swimmer sustaining minor injuries after suffering a bite from a wobbegong at Warriewood blowhole, Warriewood in January 2022 (approximately 400m south of the meshed beach at Warriewood), and a spearfisher being uninjured after fending off a White Shark while spearfishing at Magic Point, Maroubra in March 2022 (approximately 1km south of the nearest meshed beach at Maroubra).

The other four interactions were outside of the SMP area of operation and occurred at: Shelly Beach and Park Beach, Coffs Harbour and Crowdy Bay, Crowdy Heads in the Mid North Coast region, and Hyams Beach, Jervis Bay in the South Coast region.

There were three unsubstantiated shark interactions reported through third party sources. These incidents could not be confirmed by DPI, SLS NSW, NSW Police or local councils.

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

The trigger point for this objective is:

- *Trigger Point 1: Entanglements of Endangered or Critically Endangered Species, Populations or Ecological Communities in a single meshing season exceed the annual average catch plus two standard deviations of the preceding 10 years for those species;*
- *Trigger Point 2: Entanglements of Vulnerable species or ecological communities in a single meshing season exceed the annual average catch plus three standard deviations of the preceding 10 years for those species;*

- *Trigger Point 3: Entanglements of other non-target species over 2 consecutive meshing seasons exceed twice the annual average catch of the preceding 10 years for those species.*

Catch records indicate that 376 animals were reported entangled in the nets during the period from 1 September 2021 to 30 April 2022 (Table 7), and that 325 (86%) were non-target animals (Tables 7 and 8) under the 2017 JMA whereby only White, Bull and Tiger Sharks are identified as 'target' species.

Eight-six of those 376 interactions were with threatened or protected species, including:

- 28 White Sharks (18 dead, 10 released alive)
- 19 Green Turtles (14 dead, 5 released alive)
- 16 Leatherback Turtles (5 dead, 11 released alive)
- 14 Grey Nurse Sharks (5 dead, 9 released alive)
- 4 Loggerhead Turtles (2 dead, 2 released alive)
- 2 Great Hammerhead Sharks (dead)
- 1 Humpback Whale (released alive)
- 1 Common Dolphin (dead)
- 1 unidentified turtle species (released alive)

In addition, there were 267 interactions with other non-target species, including:

- 130 Rays (44 dead, 86 released alive)
- 52 Smooth Hammerheads (51 dead, 1 released alive)
- 26 Bronze Whalers\* (23 dead, 3 released alive)
- 13 Broadnose Sevengill Sharks\* (12 dead, 1 released alive)
- 13 Common Blacktips\* (12 dead, 1 released alive)
- 11 Dusky Whalers\* (10 dead, 1 released alive)
- 9 Shortfin Makos\* (7 dead, 2 released alive)
- 4 Silky Sharks\* (dead)
- 3 Mackerel Tuna (dead)
- 1 Spinner Shark\* (dead)
- 1 Port Jackson Shark (released alive)
- 1 Frigate Mackerel (dead)
- 1 unidentified whaler shark\* (dead)
- 1 unidentified hammerhead shark (dead)
- 1 unidentified shark species (dead)

\* prior to 2017/18 meshing season, these species were reported as 'target species'

Batoids (rays and skates) continue to comprise the greatest proportion of catches in the SMP at 35%, followed by Smooth Hammerheads at 14%, the collective group of 'target sharks' (Bull, White, and Tiger Sharks) accounted for approximately 14%, and Grey Nurse Sharks accounted for 3.72%.

The trigger point for the objective of '*minimising the impact on non-target species and threatened species*' was tripped in 2021/22 for Green Turtles and Leatherback Turtles (Table 8). A review report for tripped trigger points will be prepared within six months of the publication of the Annual Performance Report in accordance with clause 8.4 of the JMA and Part 7 of the Management Plan for the SMP.



Table 7 Total SMP entanglements for the 2021/22 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
<b>Target Sharks</b>												
<i>Galeocerdo cuvier</i>	Tiger Shark		1		2		2	6	5	6	11	2.9%
<i>Carcharodon carcharias</i>	White Shark	4	7	12	1	1		3	10	18	28	7.4%
<i>Carcharhinus leucas</i>	Bull Shark	3		2	1		3	3	1	11	12	3.2%
<b>Non-Target Sharks and Rays</b>												
<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark			4	2			7	1	12	13	3.5%
<i>Carcharhinus brachyurus</i>	Bronze Whaler	3	1	4	1		2	15	3	23	26	6.9%
<i>Carcharhinus obscurus</i>	Dusky Whaler		5	1	1	1	1	2	1	10	11	2.9%
<i>Isurus oxyrinchus</i>	Shortfin Mako		1	1			4	3	2	7	9	2.4%
<i>Carcharhinus falciformis</i>	Silky Shark		3	1						4	4	1.1%
<i>Carcharhinus brevipinna</i>	Spinner Shark							1		1	1	0.3%
<i>Carcharhinus sp.</i>	unidentified whaler sp.			1					1		1	0.3%
<i>Carcharhinus limbatus</i>	Common Blacktip	1	3	8				1	1	12	13	3.5%
<i>Heterodontus portusjacksoni</i>	Port Jackson Shark				1				1		1	0.3%
<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	1	16	12	6	3	3	11	1	51	52	13.8%
<i>Sphyrna mokarran</i>	Great Hammerhead Shark		1	1						2	2	0.5%
<i>Sphyrna sp</i>	unidentified hammerhead							1		1	1	0.3%
<i>Carcharias taurus</i>	Grey nurse Shark	4		6	2			2	9	5	14	3.7%
	unidentified shark				1					1	1	0.3%
<i>Myliobatis australis</i>	Southern Eagle Ray	1	12	10	6	5	5	44	50	33	83	22.1%
<i>Rhinoptera neglecta</i>	Australian Cownose Ray	1	18	1	1			8	19	10	29	7.7%
<i>Dasyatis thetidis</i>	Black Stingray				4			6	10		10	2.7%
<i>Dasyatis brevicaudata</i>	Smooth Stingray			1		1		2	4		4	1.1%
<i>Rhynchobatus australiae</i>	Whitespotted Guitarfish			1						1	1	0.3%
<i>Aetobatus ocellatus</i>	Whitespotted Eagle Ray		1			2			3		3	0.8%
<b>Non-Target Marine Mammals, Reptiles and Birds</b>												
<i>Delphinus delphis</i>	Common Dolphin				1					1	1	0.3%
<i>Megaptera novaeangliae</i>	Humpback Whale				1				1		1	0.3%
<i>Chelonia mydas</i>	Green Turtle		7	2		2	6	2	5	14	19	5.1%
<i>Caretta caretta</i>	Loggerhead Turtle		1		1	2			2	2	4	1.1%
<i>Dermochelys coriacea</i>	Leatherback Turtle		2	9	3	1	1		11	5	16	4.3%
	unidentified turtle							1	1		1	0.3%
<b>Non-Target Finfish</b>												
<i>Euthynnus affinis</i>	Mackerel Tuna				3					3	3	0.8%
<i>Auxis thazard</i>	Frigate Mackerel		1							1	1	0.3%
	<b>TOTAL</b>										<b>376</b>	<b>100.0%</b>



**Table 8 Non-target and threatened species entanglements<sup>1</sup> for 2011/12 to 2021/22 and trigger point analysis for 2021/22.**

Scientific Name	Common Name	Preceding 10 years catch data										Current reporting year	Endangered	Vulnerable	Other species	Trigger tripped (True/False)
		11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	10 Year Annual Average + 2 Std Devs	10 Year Annual Average + 3 Std Devs	2 x 10 Year Annual Avg in 2 consecutive years	
Endangered																
Carcharias taurus	Greynurse Shark	4	9	4	4	19	17	20	9	31	9	14	30.4	-	-	FALSE
Sphyrna lewini	Scalloped Hammerhead	0	1	0	0	0	1	0	1	4	0	0	3.2	-	-	FALSE
Dermochelys coriacea	Leatherback Turtle	0	0	2	0	2	1	2	4	0	2	16	4.0	-	-	TRUE
Caretta caretta	Loggerhead Turtle	0	1	0	0	4	1	0	6	1	5	4	6.4	-	-	FALSE
Dugong dugon	Dugong	0	0	0	0	0	0	0	0	0	0	0	0.0	-	-	FALSE
Eudyptula minor	Little Penguin	0	0	0	0	1	0	0	0	0	0	0	0.7			FALSE
Vulnerable																
Sphyrna mokarran	Great Hammerhead	0	0	0	0	1	1	3	1	1	1	2	-	3.6	-	FALSE
Carcharodon carcharias	White Shark	15	3	6	10	31	22	26	17	42	24	28	-	55.4	-	FALSE
Chelonia mydas	Green Turtle	1	0	10	4	13	6	9	8	8	8	19	-	18.8	-	TRUE
Megaptera novaeangliae	Humpback Whale	0	2	1	0	0	0	0	0	0	2	1	-	3.0	-	FALSE
Pinnipedia	Seals	0	0	0	0	0	1	0	0	0	1	0	-	1.5	-	FALSE
Procellariidae	Shearwater	0	0	0	0	1	0	0	0	0	0	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	0	0	1	0	9	2	3	2	0	0	0	-	-	3.6	FALSE
Delphinus delphis	Common Dolphin	0	0	4	3	4	2	4	3	7	5	1	-	-	6.4	FALSE
Squatina spp	Angelshark sp	14	3	6	1	9	5	7	7	6	4	0	-	-	12.4	FALSE
Heterodontus portusjacksoni	Port Jackson Shark	4	4	2	0	2	2	3	1	2	3	1	-	-	4.6	FALSE
Sphyrna zygaena	Smooth Hammerhead	36	22	22	42	112	71	78	87	99	60	52	-	-	126.0	FALSE
Alopias vulpinus	Thresher Shark	0	0	0	1	2	1	4	0	4	2	0	-	-	2.8	FALSE
Eretmochelys imbricate	Hawksbill Turtle	0	0	0	1	5	2	2	4	0	2	0	-	-	3.2	FALSE
Lepidochelys olivacea	Olive Ridley Turtle	0	0	0	0	0	0	1	0	0	1	0	-	-	0.4	FALSE
	Rays - combined	42	35	90	86	425	166	172	158	179	137	130	-	-	298.0	FALSE

<sup>1</sup>: 'entanglements' includes mortalities and animals released alive.

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 reducing the time between checking the nets from 96 to 72 hours. Table 9 compares the proportion of animals released alive pre - JMA (5 years before) and post – JMA (10 years after) for some major faunal groups and the total numbers of releases and captures. The data suggest that since the JMAs were implemented in 2009, there was a significant increase in the total number of animals released alive, from 27% before the JMA to a 42% average over the 13-year period from 2009 - 2022. It is important to note, however, that many of these animals are caught in very small numbers, and small changes can be reflected in greater percentages.

**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)	Annual percentage released alive over last five years					Overall % released alive post-JMA (2009/10 - 2021/22)
		2017/18	2018/19	2019/20	2020/21	2021/22	
Target sharks*	5%	25%	33%	13%	13%	26%	15%
White Shark	11%	46%	53%	43%	29%	36%	35%
Grey nurse Shark	25%	50%	56%	55%	67%	64%	55%
All hammerheads	0%	1%	1%	1%	3%	2%	1%
Other non-target sharks**	48%	13%	13%	15%	19%	13%	20%
All rays	62%	82%	77%	79%	74%	66%	76%
All dolphins	0%	0%	0%	0%	0%	0%	0%
All turtles	24%	29%	32%	40%	33%	48%	34%
Released/Interactions	223/826	180/403	157/395	196/480	144/375	142/376	1707/4066
<b>Total % released alive</b>	<b>27%</b>	<b>45%</b>	<b>40%</b>	<b>41%</b>	<b>38%</b>	<b>38%</b>	<b>42%</b>

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

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

A major incident is one that results in five or more compensable days off work, and a minor incident is one that is reportable to NSW WorkCover or results in between 2 – 4 days off work.

As there were no reported OHS incidents, this trigger point was not tripped during the 2021/22 meshing season.

### 1.5.4 Objective 4 - Transparent monitoring and reporting.

The trigger point for this objective is: *Annual performance report submitted to the Scientific Committee, the Fisheries Scientific Committee, OEH and parties to the JMA by 31 July each year.*

This requirement was met in 2021/22 in accordance with clause 8.3 of the JMA.

## 1.6 Summary of Reviews and Actions

This section summarises the trigger points which have been tripped and the status of any actions since the 2017 JMA and Management Plan came into effect in the 2018/19 meshing season.

2017/18: The trigger point for the objective of *'Minimise the impact on non-target species and to ensure that the SMP does not jeopardise the survival or conservation status of threatened species'* was tripped for three species during 2017/18 following the entanglement of twenty Grey nurse Sharks, three Great Hammerheads, and two Hawksbill Turtles. DPI completed the review report for those trigger points within six months of the publication of the 2017/18 Annual Performance Report.

2018/19: The trigger point for the objective of *'Minimise the impact on non-target species and to ensure that the SMP does not jeopardise the survival or conservation status of threatened species'* was tripped for three species during 2018/19 following the entanglement of six Loggerhead Turtles, four Leatherback Sea Turtles, four Hawksbill Turtles, and 87 Smooth Hammerheads. DPI completed the review report for those trigger points within six months of the publication of the 2018/19 Annual Performance Report.

2019/20: The trigger point for the objective of *'Minimise the impact on non-target species and to ensure that the SMP does not jeopardise the survival or conservation status of threatened species'* was tripped for four species during 2019/20 following the entanglement of thirty-one Grey Nurse Sharks, four Scalloped Hammerhead Sharks, eight Common Dolphins, and four Thresher Sharks. The trigger point for the objective of *'Minimise OHS risks associated with implementing the SMP'* was tripped with two 'minor' OHS incidents being reported. DPI completed the review report for those trigger points within six months of the publication of the 2019/20 Annual Performance Report.

2020/21: No trigger points were tripped in 2020/21.

2021/22: The trigger point for the objective of *'Minimise the impact on non-target species and to ensure that the SMP does not jeopardise the survival or conservation status of threatened species'* was tripped for two species during 2021/22 following the entanglement of 19 Green Turtles and 16 Leatherback Turtles. DPI will complete a review report for those trigger points within six months of the publication of the 2021/22 Annual Performance Report.

## 2 Changes to the Management Plan

In accordance with clause 9 of the JMA, the Management Plan and 2017 JMA are subject to review in 2022. This review process is underway between the Parties to the Agreement.

DPI Fisheries implemented the use of PSAT tagging for Grey Nurse Sharks at the end of the 2018/19 season and continued this throughout the 2021/22 season to determine the post-release survivorship of Grey Nurse Sharks caught in SMP nets.

## 3 Other Programs Complementing the SMP

### 3.1 Aerial Surveys

No helicopter aerial surveys were conducted in the 2021/22 SMP periods as this program has been completed.

### 3.2 SharkSmart Public Awareness and Education Program

DPI continued ongoing work during 2021/22 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: <https://www.sharksmart.nsw.gov.au/>

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## Appendix 1 – Monthly catch summaries for the 2021/22 meshing season

Appendix 1 Table 1: Detailed Catch Report - 1 September 2021 to 28 September 2021

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Newcastle	10/09/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	No	No	2.25	F
	Stockton	17/09/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.22	F
	Stockton	18/09/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.11	F
Central Coast North	Catherine Hill Bay	04/09/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.82	F
	The Entrance	17/09/21	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	0.65	F
	Soldiers	19/09/21	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.6	F
Central Coast South	Avoca	03/09/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.55	M
	Umina	03/09/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Alive & Released	No	No	0.75	F
	Umina	05/09/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.1	F
	Terrigal	10/09/21	<i>Carcharias taurus</i>	Grey Nurse Shark	Dead	Yes	No	2.34	F
	McMasters	16/09/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.56	Unk.
	McMasters	16/09/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.45	M
	Umina	16/09/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.68	Unk.
	Umina	16/09/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.1	F
	Umina	16/09/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1	M
	Copacabana	20/09/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	Yes	No	1.64	M
	Avoca	27/09/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	2	M
	Avoca	27/09/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.73	M
	Copacabana	27/09/21	<i>Carcharhinus sp.</i>	Whaler shark (unknown species)	Alive & Released	No	No	2	Unk.
Sydney North	Avalon	02/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.5	F
	Mona Vale	02/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	0.8	F
	Whale	02/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.6	F
	Palm	11/09/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.25	F
Sydney Central	North Narrabeen	12/09/21	<i>Dasyatis brevicaudata</i>	Smooth Stingray	Alive & Released	No	No	1.2	M
Sydney South	Cronulla	17/09/21	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.59	F
Illawarra	Austinmer	03/09/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Alive & Released	No	No	2.5	Unk.
	North Wollongong	06/09/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.75	M
	South Wollongong	06/09/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.1	F
	Thirroul	08/09/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	No	No	1.6	M
	Thirroul	08/09/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.75	F
	Thirroul	10/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.2	F
	Thirroul	10/09/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.8	F
	Thirroul	10/09/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2	F
	Thirroul	13/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	0.9	M
	Coledale	20/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.5	F
	Coledale	20/09/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.8	M

Appendix 1 Table 2: Detailed Catch Report - 29 September 2021 to 26 October 2021

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Newcastle	02/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.29	F
	Redhead	02/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.43	F
	Stockton	04/10/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.39	M
Central Coast North	The Entrance	30/09/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.78	F
	Lakes	09/10/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	2.9	F
	The Entrance	09/10/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.26	F
	Soldiers	10/10/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.8	M
	The Entrance	17/10/21	<i>Caretta caretta</i>	Loggerhead Turtle	Dead	No	No	0.72	F
Central Coast South	McMasters	30/09/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	1.98	M
	McMasters	07/10/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.7	M
	Avoca	10/10/21	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	Yes	2.1	F
	Avoca	10/10/21	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	1.9	F
	Avoca	10/10/21	<i>Dasyatis brevicaudata</i>	Smooth Stingray	Alive & Released	No	No	1	M
	McMasters	10/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	McMasters	13/10/21	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	2	F
	Copacabana	15/10/21	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	1.6	F
	Terrigal	18/10/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.82	M
	North Avoca	25/10/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	No	2.2	F
	Umina	25/10/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.98	M
Sydney North	Avalon	04/10/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.8	F
	Mona Vale	04/10/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.6	M
	Mona Vale	06/10/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.7	M
	Mona Vale	06/10/21	<i>Delphinus delphis</i>	Common Dolphin	Dead and decomposed	No	No	1.6	Unk.
	Mona Vale	15/10/21	<i>Galeocerdo cuvier</i>	Tiger shark	Dead	Yes	No	3.2	F
	Newport	15/10/21	<i>Heterodontus portusjacksoni</i>	Port Jackson Shark	Alive & Released	No	Yes	1.05	M
	Mona Vale	16/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Alive & Released	No	No	3	F
	Whale	16/10/21	<i>Megaptera novaeangliae</i>	Humpback whale	Alive & Released	No	No	8	Unk.
	Bilgola	17/10/21	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	Yes	3.5	M
	Bilgola	20/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.5	Unk.
	Warriewood	25/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
Sydney Central	Harbord	16/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	M
Sydney South	Wanda	02/10/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Alive & Released	No	Yes	2.05	F
	Cronulla	07/10/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	Yes	No	0.88	F
	Bondi	09/10/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	Yes	No	2.05	F
	Coogee	18/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.8	F
Illawarra	Wattamolla	06/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.7	F
	Garie	14/10/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	No	No	-	Unk.
	Garie	14/10/21	<i>Galeocerdo cuvier</i>	Tiger shark	Dead	No	No	3.6	F



	Garie	14/10/21	<i>Galeocerdo cuvier</i>	Tiger shark	Dead	No	No	3.6	F
	Austinmer	18/10/21	<i>Galeocerdo cuvier</i>	Tiger shark	Dead	Yes	No	3.3	M
	North Wollongong	18/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.3	Unk.
	North Wollongong	18/10/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.4	M
	North Wollongong	18/10/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.4	M
	North Wollongong	18/10/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.6	M
	North Wollongong	18/10/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	Yes	No	1.8	M
	South Wollongong	22/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.1	F
	South Wollongong	25/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	South Wollongong	25/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.2	F

Appendix 1 Table 3: Detailed Catch Report - 27 October 2021 to 23 November 2021

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Bar	01/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.21	Unk.
	Stockton	17/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.75	F
Central Coast North	Catherine Hill Bay	28/10/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.88	M
	Soldiers	28/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.5	F
	Soldiers	28/10/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	No	No	2.2	M
	Blacksmiths	01/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	0.5	F
	Blacksmiths	04/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	0.42	F
	Blacksmiths	10/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	0.86	M
	Catherine Hill Bay	12/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.43	F
Central Coast South	McMasters	29/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	McMasters	01/11/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.79	F
	McMasters	15/11/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.29	M
	McMasters	15/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.4	Unk.
	McMasters	15/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.45	F
	Terrigal	15/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Yes	No	1	F
	Copacabana	19/11/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.84	F
Sydney North	Mona Vale	08/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.2	M
	Palm	12/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.95	F
	Mona Vale	16/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Yes	No	1.15	F
Sydney Central	Harbord	29/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	North Steyne	05/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.2	F
Sydney South	North Cronulla	14/11/21	<i>Galeocerdo cuvier</i>	Tiger shark	Alive & Released	No	Yes	2.5	M
	North Cronulla	16/11/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	Yes	No	0.96	M
	North Cronulla	16/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.47	M
	North Cronulla	16/11/21	<i>Galeocerdo cuvier</i>	Tiger shark	Alive & Released	No	Yes	2.7	M

Illawarra	Austinmer	29/10/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Austinmer	29/10/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.5	F
	Thirroul	29/10/21	<i>Dasyatis brevicaudata</i>	Smooth Stingray	Alive & Released	No	No	1.2	F
	Wattamolla	03/11/21	<i>Isurus oxyrinchus</i>	Shortfin Mako	Alive & Released	No	No	2.2	F
	Thirroul	05/11/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.2	M
	Wattamolla	05/11/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.3	M
	North Wollongong	08/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.2	F
	North Wollongong	08/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.8	F
	North Wollongong	08/11/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	1.2	M
	Wattamolla	10/11/21	<i>Dasyatis brevicaudata</i>	Smooth Stingray	Alive & Released	No	No	1.2	F
	Wattamolla	10/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.4	F
	Thirroul	15/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.2	F
	Garie	19/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.5	F
	Thirroul	19/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.5	F
	North Wollongong	23/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.2	F
	Wattamolla	23/11/21	<i>Galeocerdo cuvier</i>	Tiger shark	Dead	No	No	4	F

Appendix 1 Table 4: Detailed Catch Report - 24 November 2021 to 21 December 2021

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Central Coast North	Blacksmiths	30/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead and decomposed	No	No	0.4	Unk.
	The Entrance	06/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.5	M
	Lakes	07/12/21	<i>Carcharodon carcharias</i>	White Shark	Alive & Released	No	Yes	1.73	F
	The Entrance	15/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.85	M
	The Entrance	21/12/21	<i>Chelonia mydas</i>	Green Turtle	Alive & Released	No	No	0.73	F
Central Coast South	Copacabana	24/11/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	2.05	M
	McMasters	24/11/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.84	F
	Kilcare	25/11/21	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Alive & Released	No	Yes	0.9	M
	Kilcare	25/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.1	F
	Terrigal	25/11/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.29	F
	McMasters	29/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	McMasters	07/12/21	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.95	M
	Avoca	10/12/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.95	F
	McMasters	10/12/21	<i>Carcharhinus falciformis</i>	Silky Shark	Dead	Yes	No	1.77	M
	North Avoca	10/12/21	<i>Sphyrna mokarran</i>	Great Hammerhead	Dead	Yes	No	2	F
	Terrigal	10/12/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	1.86	M
	Terrigal	13/12/21	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.05	M
	Copacabana	14/12/21	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.94	M
	McMasters	14/12/21	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	2	M
	McMasters	14/12/21	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.96	M



	Copacabana	17/12/21	<i>Carcharias taurus</i>	Greynurse Shark	Dead	Yes	No	1.92	M
	North Avoca	17/12/21	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.84	M
	Terrigal	17/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	North Avoca	21/12/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.2	F
Sydney North	Palm	30/11/21	<i>Carcharias taurus</i>	Greynurse Shark	Dead	Yes	No	2.4	F
	Mona Vale	04/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	Palm	17/12/21	<i>Dasyatis thetidis</i>	Black Stingray	Alive & Released	No	No	0.7	F
	Whale	17/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Yes	No	0.7	F
	Mona Vale	20/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Yes	No	1.4	Unk.
	Mona Vale	20/12/21	<i>Galeocerdo cuvier</i>	Tiger shark	Dead	Yes	No	1.5	M
	Warriewood	20/12/21	<i>unidentified shark</i>	unidentified shark	Dead	No	No	-	Unk.
Sydney Central	Curl Curl	24/11/21	<i>Carcharhinus obscurus</i>	Dusky Whaler	Alive & Released	No	Yes	1.15	M
	Curl Curl	29/11/21	<i>Caretta caretta</i>	Loggerhead Turtle	Alive & Released	No	No	-	Unk.
	North Narrabeen	02/12/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.2	F
	Harbord	10/12/21	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	2.1	F
	Harbord	10/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Yes	No	1	F
Sydney South	Bondi	06/12/21	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.46	Unk.
	Cronulla	06/12/21	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.64	Unk.
Illawarra	Austinmer	29/11/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	Austinmer	29/11/21	<i>Carcharias taurus</i>	Greynurse Shark	Dead	No	No	2.4	F
	Wattamolla	29/11/21	<i>Carcharias taurus</i>	Greynurse Shark	Dead	Yes	No	2.2	F
	Wattamolla	01/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.5	F
	Wattamolla	01/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Garie	03/12/21	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	2.8	F
	Garie	03/12/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	1.8	M
	North Wollongong	06/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Garie	14/12/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	No	No	2	M
	Austinmer	17/12/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Alive & Released	No	No	2	F
	North Wollongong	17/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	North Wollongong	17/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.3	F
	Thirroul	17/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	Thirroul	17/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.6	M
	Wattamolla	17/12/21	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	3	F
	Wattamolla	17/12/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	1.9	M
	Coledale	20/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Coledale	20/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.6	F
	North Wollongong	20/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F

Appendix 1 Table 5: Detailed Catch Report - 22 December 2021 to 18 January 2022

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Newcastle	11/01/22	<i>Carcharodon carcharias</i>	White Shark	Dead and decomposed	No	No	2.08	F
Central Coast North	Catherine Hill Bay	30/12/21	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	1.1	F
	Catherine Hill Bay	08/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.95	F
	Catherine Hill Bay	08/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.9	F
	Catherine Hill Bay	08/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	0.85	F
	Catherine Hill Bay	08/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	0.8	F
	Catherine Hill Bay	08/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	0.88	F
	Blacksmiths	18/01/22	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	2.1	F
Central Coast South	Terrigal	29/12/21	<i>Chelonia mydas</i>	Green Turtle	Alive & Released	No	No	0.6	Unk.
	North Avoca	31/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.8	F
	Kilcare	11/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.99	F
	Umina	16/01/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	1.88	F
Sydney North	Warriewood	24/12/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.05	M
	Bilgola	03/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.8	M
	Warriewood	03/01/22	<i>Caretta caretta</i>	Loggerhead Turtle	Dead	No	No	1.1	F
Sydney Central	Narrabeen	24/12/21	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.65	Unk.
	North Narrabeen	30/12/21	<i>Caretta caretta</i>	Loggerhead Turtle	Alive & Released	No	No	1	Unk.
	North Steyne	12/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.08	F
Sydney South	Bronte	05/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead and decomposed	Yes	No	1.43	F
	Cronulla	05/01/22	<i>Carcharhinus leucas</i>	Bull Shark	Alive & Released	No	No	2	F
	Bronte	10/01/22	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	1.86	M
	Bronte	10/01/22	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	1.73	M
Illawarra	Coledale	23/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Wattamolla	29/12/21	<i>Galeocerdo cuvier</i>	Tiger shark	Alive & Released	No	No	3	F
	Wattamolla	29/12/21	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	No	No	2	M
	Coledale	31/12/21	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Garie	31/12/21	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.4	F
	Garie	31/12/21	<i>Chelonia mydas</i>	Green Turtle	Dead	No	No	1.1	F
	Garie	03/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.4	F
	Austinmer	05/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.7	M
	Austinmer	05/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.1	F
	Wattamolla	05/01/22	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	2.7	F
	Wattamolla	05/01/22	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	Yes	No	2.8	M
	Garie	07/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.3	M
	Thirroul	07/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Coledale	10/01/22	<i>Carcharodon carcharias</i>	White Shark	Dead	Yes	No	1.5	F
	Coledale	10/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.5	M
	Coledale	10/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.5	M

	Coledale	10/01/22	<i>Notorynchus cepedianus</i>	Broadnose Sevengill Shark	Dead	No	No	1.4	M
	Thirroul	14/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.8	M
	Austinmer	17/01/22	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	No	No	1.9	M
	North Wollongong	17/01/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	No	No	1.55	M

Appendix 1 Table 6: Detailed Catch Report - 19 January 2022 to 15 February 2022

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.6	F
Central Coast North	The Entrance	23/01/22	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.66	M
	Catherine Hill Bay	30/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.9	M
	Catherine Hill Bay	30/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.8	M
	Catherine Hill Bay	30/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	1	M
	Lakes	30/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.22	F
	Shelly	30/01/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	No	No	1.38	F
	Blacksmiths	30/01/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.94	M
	Blacksmiths	30/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.08	F
	Blacksmiths	01/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.1	F
	Catherine Hill Bay	10/02/22	<i>Chelonia mydas</i>	Green Turtle	Alive & Released	No	No	0.73	F
	Catherine Hill Bay	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.92	M
	Catherine Hill Bay	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.96	M
	Catherine Hill Bay	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.95	M
	Catherine Hill Bay	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive	No	No	0.93	M
	Catherine Hill Bay	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.95	M
	Catherine Hill Bay	10/02/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.9	M
	Blacksmiths	10/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.99	M
	Blacksmiths	10/02/22	<i>Auxis thazard</i>	Frigate Mackerel	Dead	No	No	0.42	Unk.
	Blacksmiths	10/02/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Alive & Released	No	No	0.92	M
	Blacksmiths	11/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.32	M
	Lakes	14/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.12	M
	Blacksmiths	14/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.79	M
	The Entrance	14/02/22	<i>Chelonia mydas</i>	Green Turtle	Dead	No	No	0.78	F
Central Coast South	Umina	20/01/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Dead and decomposed	No	No	1.5	Unk.
	McMasters	31/01/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Whole	No	2.21	M
	Kilcare	09/02/22	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	No	No	2	M
	North Avoca	13/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.34	Unk.
Sydney Central	Harbord	25/01/22	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.7	Unk.
Sydney South	Bondi	27/01/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.29	M
	Bondi	31/01/22	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.54	Unk.

	Wanda	31/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.4	Unk.
Illawarra	Coledale	21/01/22	<i>Carcharhinus brachyurus</i>	Bronze Whaler	Dead	No	No	1.8	M
	North Wollongong	24/01/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	No	No	1.5	M
	Austinmer	26/01/22	<i>Isurus oxyrinchus</i>	Shortfin Mako	Dead	Yes	No	1.1	F
	Austinmer	31/01/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Wattamolla	09/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.4	F
	Wattamolla	09/02/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	No	No	1.8	M
	Wattamolla	14/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.5	F

Appendix 1 Table 7: Detailed Catch Report – 16 February 2022 to 15 March 2022

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	16/02/22	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	2.74	F
	Stockton	17/02/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.41	M
	Stockton	21/02/22	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	2.9	F
	Stockton	23/02/22	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	2.95	F
	Stockton	24/02/22	<i>Carcharias taurus</i>	Grey nurse Shark	Alive & Released	No	No	2.78	F
	Stockton	28/02/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	2.98	M
Central Coast North	Blacksmiths	16/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.9	M
	Blacksmiths	18/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.03	F
	Blacksmiths	18/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.83	M
Central Coast South	Kilcare	24/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	0.93	M
Sydney North	Palm	18/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.2	M
	Bilgola	05/03/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	2.4	Unk.
Sydney Central	Queenscliff	28/02/22	<i>Aetobatus ocellatus</i>	White Spotted Eagle Ray	Alive & Released	No	No	1	M
	North Narrabeen	13/03/22	<i>Aetobatus ocellatus</i>	White Spotted Eagle Ray	Alive & Released	No	No	1	M
	Curl Curl	14/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Dead	No	No	1.8	Unk.
Sydney South	Cronulla	28/02/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	Yes	No	3.7	F
	North Cronulla	13/03/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	2.7	F
Illawarra	Garie	23/02/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Garie	23/02/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Garie	23/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.4	M
	Garie	23/02/22	<i>Galeocerdo cuvier</i>	Tiger shark	Alive & Released	No	No	4	M
	South Wollongong	25/02/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1.2	F
	Coledale	28/02/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	No	No	3	F
	North Wollongong	28/02/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	F
	Garie	13/03/22	<i>Carcharhinus brevipinna</i>	Spinner Shark	Dead	Yes	No	1.4	F

Appendix 1 Table 8: Detailed Catch Report – 16 March 2022 to 12 April 2022

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Hunter	Stockton	25/03/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	1.67	M
	Stockton	10/04/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	No	No	1.52	M
Central Coast North	Caves Beach	18/03/22	<i>Chelonia mydas</i>	Green Turtle	Dead	No	No	0.65	F
	Caves Beach	21/03/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1	F
	Shelly	21/03/22	<i>Carcharhinus falciformis</i>	Silky Shark	Dead	No	No	1.75	M
	Blacksmiths	21/03/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.06	M
	Caves Beach	25/03/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	Yes	No	0.91	F
	Shelly	28/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.7	Unk.
	Blacksmiths	06/04/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	0.93	F
	Catherine Hill Bay	10/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.33	F
	Caves Beach	10/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.44	F
	Soldiers	10/04/22	<i>Aetobatus ocellatus</i>	White Spotted Eagle Ray	Alive & Released	No	No	1.5	Unk.
	Soldiers	10/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.15	F
	Soldiers	10/04/22	<i>Carcharhinus falciformis</i>	Silky Shark	Dead	Yes	No	1.36	F
	Soldiers	10/04/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.79	M
	Soldiers	10/04/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	Yes	No	1.52	F
	Soldiers	10/04/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	Yes	No	1.75	F
	Soldiers	10/04/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	No	No	1.78	M
	Blacksmiths	10/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Dead	Yes	No	1.43	Unk.
	Caves Beach	11/04/22	<i>Sphyrna mokarran</i>	Great Hammerhead	Dead	Yes	No	2.65	M
	Soldiers	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.23	F
	Soldiers	11/04/22	<i>Galeocerdo cuvier</i>	Tiger shark	Alive & Released	No	Yes	2.02	M
	Blacksmiths	11/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	0.91	M
Central Coast South	Umina	16/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Dead	Yes	No	1.1	Unk.
	Kilcare	18/03/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.05	F
	North Avoca	18/03/22	<i>Chelonia mydas</i>	Green Turtle	Alive & Released	No	No	0.7	Unk.
	Copacabana	22/03/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.61	F
	Umina	28/03/22	<i>Rhynchobatus australiae</i>	White-spotted Guitarfish	Dead	Yes	No	1.68	F
	Copacabana	05/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.1	Unk.
	Copacabana	11/04/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	Yes	No	1.62	F
	Kilcare	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	North Avoca	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Whole	No	1.22	F
	North Avoca	11/04/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	Yes	No	1.94	M
	Terrigal	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Whole	No	0.9	F
	Terrigal	11/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	Whole	No	0.74	M
Sydney North	Avalon	16/03/22	<i>Euthynnus affinis</i>	Mackerel tuna	Dead	No	No	0.57	Unk.
	Avalon	16/03/22	<i>Euthynnus affinis</i>	Mackerel tuna	Dead	No	No	0.57	Unk.
	Avalon	16/03/22	<i>Euthynnus affinis</i>	Mackerel tuna	Dead	No	No	0.57	Unk.

	Newport	16/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.67	Unk.
	Palm	16/03/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	1.67	F
	Whale	18/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.6	Unk.
	Newport	26/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.8	Unk.
	Avalon	11/04/22	<i>Carcharhinus obscurus</i>	Dusky Whaler	Dead	No	No	1.3	M
Sydney South	Bondi	18/03/22	<i>Carcharhinus leucas</i>	Bull Shark	Dead	Yes	No	1.96	F
	Coogee	18/03/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.9	Unk.
	Cronulla	25/03/22	<i>Chelonia mydas</i>	Green Turtle	Dead and decomposed	No	No	0.8	Unk.
	Elouera	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	Elouera	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.4	F
	Elouera	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	0.9	F
Illawarra	Garie	18/03/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	Thirroul	21/03/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	Unk.
	North Wollongong	24/03/22	<i>unidentified turtle</i>	unidentified turtle	Alive & Released	No	No	0.8	Unk.
	North Wollongong	24/03/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.2	F
	Wattamolla	24/03/22	<i>Sphyrna sp</i>	Hammerhead (unknown species)	Dead	No	No	-	Unk.
	Wattamolla	04/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Wattamolla	04/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Wattamolla	04/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Coledale	06/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	1	F
	Austinmer	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.2	M
	Austinmer	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Coledale	11/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	1	F
	Coledale	11/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	1	F
	Thirroul	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1	F
	Thirroul	11/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1.4	F

Appendix 1 Table 9: Detailed Catch Report – 13 April 2022 to 30 April 2022

Region	Beach	Date	Scientific Name	Common Name	Status	Samples taken (yes/no/whole)	Tagged	Size (m) FL	Sex
Central Coast North	Lakes	15/04/22	<i>Carcharhinus falciformis</i>	Silky Shark	Dead	No	No	1.65	F
	Lakes	15/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.13	F
	Lakes	15/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	No	No	1.12	F
	Blacksmiths	20/04/22	<i>Chelonia mydas</i>	Green Turtle	Alive & Released	No	No	0.7	Unk.
	Caves Beach	21/04/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	0.92	F
	Soldiers	26/04/22	<i>Carcharhinus limbatus</i>	Common Blacktip	Dead	No	No	1.85	F
Central Coast South	Terrigal	14/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.3	Unk.
	North Avoca	15/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.2	Unk.
	Avoca	18/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.1	Unk.
	North Avoca	18/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.2	Unk.



	McMasters	20/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Alive & Released	No	No	1.8	Unk.
	North Avoca	27/04/22	<i>Dermochelys coriacea</i>	Leatherback Turtle	Dead	Yes	No	1.1	Unk.
Sydney Central	Dee Why	14/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Dead	Yes	No	1.22	F
	Manly	14/04/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	Yes	No	1.16	F
Sydney South	Bronte	14/04/22	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.59	Unk.
Illawarra	Coledale	15/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	1	M
	Coledale	15/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	1	M
	Thirroul	15/04/22	<i>Myliobatis australis</i>	Southern Eagle Ray	Alive & Released	No	No	1	F
	Garie	18/04/22	<i>Carcharodon carcharias</i>	White Shark	Dead	No	No	2	Unk.
	Thirroul	22/04/22	<i>Sphyrna zygaena</i>	Smooth Hammerhead	Dead	No	No	1	M
	Austinmer	27/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	1	M
	Coledale	27/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Alive & Released	No	No	1	F
	Austinmer	29/04/22	<i>Rhinoptera neglecta</i>	Australian Cownose Ray	Dead	No	No	1	M
	Wattamolla	30/04/22	<i>Chelonia mydas</i>	Green Turtle	Dead	Yes	No	0.8	Unk.