GOVERNMENT OF
WESTERN AUSTRALIA

Western Australian Shark Hazard Mitigation Drum Line Program 2014-17

Operational Environmental Management Plan

August 2014

TABLE OF CONTENTS

DEFINITIONS

In this Plan:

DoE	means the Commonwealth Department of the Environment
DoF	means the Western Australian Department of Fisheries
DoF Operations Manager	means the officer at the Department of Fisheries responsible for operational liaison
DPaW	means the Western Australian Department of Parks and Wildlife
DPC	means the Western Australian Department of the Premier and Cabinet
EP Act	means the *Environmental Protection Act 1986* (WA)
EPA	means the Western Australian Environmental Protection Authority
EPBC Act	means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth)
FHPA	Fish Habitat Protection Area as defined under the FRMA
Fork length	means the horizontal distance from the tip of the snout to the fork of the tail
FRMA	means the *Fish Resources Management Act 1994* (WA)
Interdorsal fin length	means the horizontal distance between the first and second dorsal fins measured from the first dorsal fin origin to the second dorsal fin insertion
Marine Monitored Area (MMA)	means the areas in which static drum lines may be deployed (as defined in section 3.2.1)
Marine protected area	means any marine protected area designated under the *Conservation and Land Management Act 1984* or the FRMA
MNES	means matters of national environmental significance as defined under the EPBC Act
Non-target species	means all vertebrate species that are not target species.
Observer program	means the provision of individuals to observe operational performance of the Program
OEPA	means the Office of the Environmental Protection Authority
PER	means the Public Environmental Review
Plan	means this document titled "Operational Environmental Management Plan for the Western Australian Shark Hazard Mitigation Drum Line Program 2014-17"

Static drum lines	means drum lines to be set continuously (or as directed by the Proponent) at approximately 1km offshore of popular swimming beaches and surf breaks within the MMAs between 15 November and 30 April each year and monitored daily
Temporary drum lines	means drum lines deployed in response to an identified shark threat or incident anywhere in Western Australian waters at any time, until 30 April 2017. Temporary drum lines would be set for a maximum of one hour in response to a sighting or for up to one week in response to an incident
Target species	means, in reference to static drum lines, any white shark (*Carcharodon carcharias*), tiger shark (*Galeocerdo cuvier*) or bull shark (*Carcharhinus leucas*) with a total length of three metres or greater; or in reference to temporary drum lines, any shark considered to be posing a threat or responsible for an incident
Total length	means the distance from the snout to a point on the horizontal axis intersecting a perpendicular line extending downward from the tip of the upper caudal lobe to form a right angle
WC Act	means the *Wildlife Conservation Act 1950* (WA)
Western Australian waters	has the same meaning defined by Geoscience Australia and is 'coastal waters between the territorial sea baseline, usually the low water line along the coast, and a line three nautical miles seaward from the baseline'

1 INTRODUCTION

1.1 Name of Plan

This document is the Operational Environmental Management Plan (the Plan) for the Western Australian Shark Hazard Mitigation Drum Line Program 2014-17 (the Program).

1.2 Purpose of the Plan

The purpose of the Plan is to:

(1) ensure drum lines are deployed through each MMA between 15 November and 30 April, commencing 15 November 2014 and ceasing 30 April 2017.
(2) ensure the Program is implemented in a manner that minimises impacts on target sharks under three metres in total length and on non-target marine fauna;
(3) ensure that mortality, including post release mortality, of all bycatch is minimised; and
(4) set out the management measures, animal handling protocols, operational protocols, compliance, research and reporting requirements for the delivery of the Program.

1.3 Date of commencement

The Plan will come into force on 15 November 2014 and will be in force for a period of three years between 15 November and 30 April 2014-17.

1.4 Definition of the drum line program

(1) The activity of drum lining is herein defined as the setting of up to:
    a. 60 static baited drum lines within the metropolitan and south west region Marine Monitored Areas (MMAs); and
    b. 12 temporary drum lines for responding to identified shark threats or incidents within the metropolitan and south west region MMAs. (See Section 3 and Attachment 13.1).
(2) Target species in reference to static drum lines are any white shark (*Carcharodon carcharias*), tiger shark (*Galeocerdo cuvier*) or bull shark (*Carcharhinus leucas*) three metres or greater in total length.
(3) Target species in reference to temporary drum lines in response to a sighting are any white shark (*Carcharodon carcharias*), tiger shark (*Galeocerdo cuvier*) or bull shark (*Carcharhinus leucas*) three metres or greater in total length.
(4) Target species in reference to temporary drum lines in response to an incident is any shark considered responsible for the incident.
(5) Static and temporary drum lines will be set between 15 November and 30 April each year for a period of three years, commencing 15 November 2014 and ceasing 30 April 2017.
(6) Static drum lines are to be set approximately 1km (0.53 nautical miles) offshore of popular swimming beaches and surf breaks within the two MMAs.

1.5 Authority for the activity

The Program is authorised by approvals granted under the *Environmental Protection Act 1986* (WA) (EP Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The Program also take place under exemptions from the *Fish Resources Management Act 1994* (WA) (FRMA) and licences under the *Wildlife Conservation Act 1950* (WA) (WC Act).

1.6 Proponent of the activity

The Proponent is taken to mean the Western Australian Department of the Premier and Cabinet (DPC).

1.7 Environmental assessment

The Plan is a requirement under the PER which was conducted under bilateral agreement between the EPA and DoE under the EP Act and the EPBC Act respectively.

2 AIMS AND OBJECTIVES

2.1 Development of the program

The Program has been developed following; a close examination of shark control programs in other jurisdictions; consultation with a wide range of stakeholders; input from public submission processes, and recommendations arising from the Review of the Western Australian Shark Hazard Mitigation Drum Line Program 2013-14 to avoid, minimise and rectify environmental impacts.

2.2 Program aims

The aims of the Program are to:

(1) offer an additional and complementary measure of shark hazard mitigation to those already implemented as part of the Government's shark hazard mitigation strategy (see p-12 of the PER) at high use swimming beaches and surf breaks during peak summer periods of usage; and
(2) minimise environmental impacts.

2.3 Performance objectives

The performance objectives of the Program are to:

(1) provide the public with an additional measure of shark hazard mitigation through the deployment of drum lines at select high use swimming beaches and surf breaks in the metropolitan and south west regions during peak summer periods;
(2) operate within acceptable catch levels for target species and within anticipated catch levels for non-target species;
(3) monitor catch data to inform trigger points and implement appropriate contingency measures;
(4) assess post release-survivorship of target species less than three metres total length;
(5) collect catch, biological and operational data to allow for ongoing monitoring of the Program and annual and post-Program reviews;
(6) use data collected from the Program to increase knowledge and understanding of marine systems, marine species biology and movement patterns and population levels; and
(7) comply with condition X of Ministerial Statement No. XX/Condition X of EPBC Approval number X.

2.4 Performance indicators

Performance Indicator (1)
Up to 30 static drum lines in each MMA deployed and serviced for no less than 90% of the required time each season (i.e. between 15 November and 30 April).

Performance indicator (2)
Acceptable catch levels for target species, and anticipated catch levels for non-target species:

Acceptable catch level for target species	
White	25 over three years
Tiger	900 over three years
Bull	10 over three years
Anticipated catch levels for non-target species	
Dusky	<10 per year
Grey nurse	None to only a few per year
Shortfin mako	between five and 20 per year
Other non-listed elasmobranchs	between five and 20 per year, most likely to comprise of a number of species

Performance indicator (3)

Trigger Points	
Target species	
White	20
Tiger	350
Bull	10
Listed elasmobranchs	
Dusky	30
Grey nurse	5
Shortfin mako	50
Non-listed elasmobranchs	
Cumulative of species	50
Other listed marine fauna	
Marine life including seals, sea lions, whale sharks, manta rays, dolphins, turtles and seabirds	3

Performance indicator (4)

4.1 Satellite tags are to be fitted to all white sharks that are less than three metres total length and considered to be in a condition to survive being tagged and released.

4.2 Satellite tags are to be fitted to the first 20 tiger sharks in the metropolitan region that are less than three metres total length and considered to be in a condition to survive being tagged and released.

4.3 Satellite tags are to be fitted to all bull sharks that are less than three metres total length and considered to be in a condition to survive being tagged and released.

Performance indicator (5)

Tissue samples taken from all sharks and EPBC Act listed species.

Performance indicator (6)

6.1 Catch data provided weekly to DPC and then to DoF.

6.2 Catch data provided to the OEPA and DoE within seven days of the end of each month of the Program following verification of data by DoF, including species identification.

6.3 Notification of catch rates meeting trigger points and details of contingency actions to be taken provided to the OEPA and DoE within 24 hours of meeting trigger level.

6.4 OEPA, DPaW and DoE to be notified of all white sharks captured as part of the Program within 24 hours of the capture.

6.5 OEPA, DPaW and DoE to be notified of the capture of any marine mammal or marine turtle within 24 hours of the interaction.

6.6 Reports on catch data, operational performance, effectiveness of management measures and recommendations for program changes provided to the OEPA, DPaW and DoE within two months of the close of each Program season (e.g. by 30 June each year).

6.7 A final evaluation of the Program including; an analysis of catch data; operational performance; effectiveness of management measures, and contributions to research to be finalised two months following the completion of the annual review and provided to the OEPA, DPaW and DoE by 31 August 2017.

3 TIMING AND LOCATION

3.1 Timing

Static and temporary drum lines will be set between 15 November and 30 April each year for a period of three years, commencing 15 November 2014 and ceasing 30 April 2017.

3.2 Location

(1) The metropolitan MMA extends from Ocean Reef (-31° 44.6038', 115° 43.3727') to Port Beach (-32° 2.4354', 115° 44.4630').

(2) The south west MMA extends from Quindalup (-33° 37.8569', 115° 8.9470') to Prevelly (-33° 58.9200', 114° 59.3834').

Up to 30 static drum lines are proposed to be set in each of three phases within the south west MMA as follows.[1]

Phase 1:	At popular surf breaks between Moses Rock and Prevelly – November to early December.
Phase 2:	At high use swimming beaches and popular surf breaks between Dunsborough and Three Bears – early December to early February to coincide with school holidays and Surf Life Saving WA patrols.
Phase 3:	At popular surf breaks between Yallingup and Prevelly from approximately the second week of February until 30 April.

Twelve drum lines will be kept in reserve for responding to an identified shark threat or incident within an MMA.

3.2.1 Marine protected areas

(1) The MMAs overlap with the Marmion Marine Park and Cottesloe FHPA in the metropolitan region and with the Ngari Capes Marine Park in the south west region.
(2) Static drum lines will not be deployed within any gazetted or proposed marine sanctuary zone or gazetted or proposed marine recreation zone in any Western Australian marine parks as designated under the *Conservation and Land Management Act 1984*. Static drum lines will not be placed within any FHPA as designated under the FRMA.
(3) Temporary drum lines may be set within marine protected areas in response to an identified shark threat or incident.

As detailed in Section 7, if an identified shark threat or incident requires a response within a marine protected area, appropriate consultation will be held between the DoF Operations Manager and DPaW prior to giving an order to deploy.

[1] This schedule may vary depending on changes to Surf Life Saving WA patrols, following consultation with the surfing community in the south west or other logistical considerations.

4 MANAGEMENT MEASURES

4.1 Drum line deployment

For static baited drum lines deployed within the metropolitan and south west MMAs:

(1) DPaW and DoF to be consulted on the locations for deployment of static drum lines.
(2) The GPS location of all drum lines to be recorded upon initial deployment on 15 November each year, if moved throughout the season, and upon final retrieval on 30 April each year.
(3) The drum line array in each MMA to be monitored and serviced between 0600 and 1800 seven days per week.[2]

4.1.1 Events or activities affecting drum line deployment

There may be specific events during the life of the Program which require the removal of drum lines from the water or alterations to their locations of deployment. At the time of writing the Plan, the only event to which this applies is the annual Rottnest Channel Swim. Drum lines will be removed the day before the swim and returned to the water the day following the swim each year. The relevant authorities (for example, OEPA, DoE, Department of Transport) will be notified of any additional events or activities which may require the removal or re-deployment of drum lines as they become applicable through the life of the Program.

4.2 Bait

(1) Where available, a preference is for the use of shark meat. Where shark meat is not available, consideration to be given to using less oily fishes to reduce scavenging.
(2) Bait to be checked at both the commencement of, and prior to the end of, each patrol day and at all other times lines are checked.[3] All used baits shall be disposed of on-shore. See section 6.13 for details on data recording.

4.3 Drum line specifications

Each drum line to comprise of a minimum of two PVC buoys and a large (no smaller than an approximate 25/0 circle-design) hook. The hook is to sit a minimum of approximately two metres below the surface of the water, and be anchored to the sea bed using an approximately weighted 8-12 kg anchor by a length of polypropylene rope (length of rope dependent upon water depth and local conditions). Each component of the rig is to be sectioned, primarily through the use of swivel shackles. A third float may be added for more effective handling of an animal, in particular in rough sea conditions. Diagrams of the drum line configurations are at Attachment 13.2.

4.3.1 Modifications to the drum line configuration

The following modifications to the drum line configuration may be required through the life of the Program:

(1) Different size and style hooks as part of a gear selectivity trial, whilst ensuring that the hook is no smaller than an approximate 25/0 circle design (see section 9.1.2).
(2) The use of hook timers on drum lines to determine how long an animal has been on a hook, which can better inform rates of survivability (see section 9.1.3).
(3) Incorporation of 'smart drum line' technology which raises an alert that an animal is caught on a hook using satellite linked receivers.

[2] Subject to a vessel being unable to operate due to inclement weather.
[3] In the event that a vessel cannot operate due to inclement weather lines will be re-baited as soon as practicable at the resumption of patrols.

4.4 Vessel and associated requirements

Vessels to have the following capabilities and/or equipment:

(1) approximate draft - 1.5 m or less;
(2) approximate length – 15 m or greater;
(3) deck space longer than 6 m;
(4) Automatic Location Communicator (ALC) capabilities, and ability to maintain a GPS Track log;
(5) lifting equipment rated for safe working loads in excess of 1.5 tonne;
(6) ramp or suitable and approved alternative system (such as a sling, or conveyor system) capable of bringing a large marine animal on board minimising further injury to the animal;
(7) ability to store retained catch from a single day on board the vessel;
(8) vessels surveyed to carry above-deck loads in excess of 1.5 tonne;
(9) firearm, secure storage and relevant licences;
(10) pumping equipment or deck wash system suitable to ventilate gills of live sharks prior to release.
(11) freezer capacity for storing "general" biological samples such as tissue samples, for stable isotope analyses; and
(12) facility for the safe storage of chemicals (i.e. ethanol) required for preservation of tissue samples for the purpose of genetic analyses.[4]

4.5 Acceptable catch levels

The acceptable catch levels for target species, and anticipated catch levels for non-target species under the Program are detailed at Table 1.

Table 1. Acceptable catch levels

Acceptable catch level for target species	
White	25 over three years
Tiger	900 over three years
Bull	10 over three years
Anticipated catch levels for non-target species	
Dusky	<10 per year
Grey nurse	None to only a few per year
Shortfin mako	between five and 20 per year
Other non-listed elasmobranchs	between five and 20 per year, most likely to comprise of a number of species

Catches of other listed elasmobranchs including whale sharks and manta rays, and other listed marine fauna including seals and sea lions, turtles, whales, dolphins and seabirds are expected to be close to zero. It should be noted that these are the *anticipated* catch levels, and do not represent acceptable catch levels.

[4] Note that some tissue samples will need to be frozen while others will be required to be stored in ethanol.

4.6 Trigger points

The figures at Table 2 represent levels at which contingency measures will be required to be employed. The figures are cumulative totals over the three years of operations and relate to animals that are either destroyed or are considered to have died following release (i.e. not simply catch numbers):

Table 2. Trigger points

Trigger Points	
Target species	
White	20
Tiger	350
Bull	10
Listed elasmobranchs	
Dusky	30
Grey nurse	5
Shortfin mako	50
Non-listed elasmobranchs	
Cumulative of species	50
Other listed marine fauna	
Marine life including seals, sea lions, whale sharks, manta rays, dolphins, turtles and seabirds	3

In determining the cumulative totals for trigger points, animals released in a condition (1) (see 5.1.1) will be considered to have survived and not be counted towards trigger points. Any animals released in a condition (2) or (3), notwithstanding information to the contrary such as might be obtained from satellite tag data (see 4.6.1), will be considered to have died for the purpose of determining cumulative mortality for trigger points.

As per 4.6.1, if a satellite signal is not received at least one week following release the animal will be considered to have died for the purpose of determining cumulative total mortality. If subsequent data is received to suggest the animal is alive, this should be considered by the relevant authorities in the context of trigger points.

Should a trigger point be met, as per Performance Indicator 6.3 (Section 2.4), DPC will notify the OEPA and DoE within 24 hours and advise of the contingency measure(s) to be taken.

4.6.1 Determining survivability of released sharks

Satellite tags will be used to give an indication of the post-release survival of individual sharks released as part of the Program.[5]

Satellite tags provide location data when the dorsal fin breaks the surface of the water.

White sharks

Where safe to do so, white sharks that are less than three metres total length and assessed as being in either condition (1) or condition (2) (see 5.1.1) will be fitted with fin mounted satellite tags.

Tiger sharks

Where safe to do so, fin mounted satellite tags will be fitted to the first 20 tiger sharks that are captured in the metropolitan[6] MMA, are less than three metres total length, and assessed as being in either condition (1) or condition (2) (see 5.1.1).

[5] Due to accuracy of location data received from satellite tags, and the need for a shark's dorsal fin to break the surface to send a transmission, satellite tags are not suitable for use as a public safety alert tool. Satellite transmissions received as part of the Program will therefore not form part of the Shark Response Unit alert protocols.

[6] Tagging tiger sharks in the metropolitan region offers greater access to DoF staff and supplies should they be required.

Bull sharks
Where safe to do so, fin mounted satellite tags will be fitted to all bull sharks that are less than three metres and assessed as being in either condition (1) or condition (2) (see 5.1.1).

For the purpose of determining cumulative mortality, sharks that are fitted with a satellite tag will initially be assumed to have not survived the catch and release process. If a signal is received at least one week following its release this will be considered as strong evidence for post release survival, at which time that tagged shark will be removed from the number of cumulative mortalities. This approach is considered to be fully conservative because it is possible that there will never be a detection from a shark that has survived as some tagged sharks that survive may not swim near the surface in a manner sufficient to permit transmission of a signal from the tag. In addition, fin mounted tags can be subject to bio-fouling and removal by other animals or activities.

Due to the high cost and high risk of loss of individual satellite tags, and the level of animal handling involved in fitting the tags, an assessment will be made on the effectiveness of both the procedure and the devices following the deployment of the first 20 tags on tiger sharks (and in consideration of the number of satellite tags deployed on other target species by that time). Advice will be sought from DoF on the relative merit in proceeding with this type of tagging. The review will include assessment of whether sufficient tag data is received to generate an estimate of post release mortality. The OEPA and DoE will be advised of the outcomes of the advice and will be consulted on decisions to continue or otherwise the tagging efforts.

4.7 Contingency measures

Data will be provided to DPC and then to DoF and DPaW on a weekly basis. Ongoing monitoring of catches will enable prompt management actions to be taken. Dependent upon the trigger point that is met, one, or a combination of, the following contingency measures may be implemented (Table 3).

Table 3. Contingency measures

Issue	Contingency measure	Duration	Considerations	Notes
Trigger point for a species met, with data to show high proportion of catch (>50%) dead on first patrol of the day (i.e. believed to have perished overnight).	Effort reductions through the discontinuation of baiting hooks overnight. If catch data is significant in only one region then baiting overnight may continue in the other region.	Until the end of the season at which point a review will be undertaken.	Early morning beach users may be at greater risk due to unbaited lines in the water.	Media release to advise early morning swimmers and beach users that drum lines are not being baited overnight.
Trigger point for a species met and catch data suggests a correlation with a particular bait type.	Change the type of bait used on hooks. If catch and correlation data is significant to a particular region then bait usage may not change in the other region unless considered appropriate or practical to do so.	Until the end of the season at which point a review will be undertaken.	Different baits may result in an increased catch of other non-target species. Catch to be monitored closely and bait types adjusted if necessary.	Subject to bait availability.
Trigger point for capture of other listed marine fauna met (e.g. with whales and/or dolphins).	Apply acoustic pingers to each drum line rig; one at the surface near the buoy and one at every 10m depth on the anchor rope in the region(s) where captures have occurred.	Until the end of the season at which point a review will be undertaken.		
Trigger point for a species met and catch data suggests high catch rates in a particular location.	Increased patrols of drum lines in the location where high catch rates have occurred to take efforts to reduce mortality of undersize target species or non-target species.	Until the end of the season, or earlier if catch data in other locations suggest a negative effect of reduced patrols.		
Any trigger point met	Undertake a within season review of the Program.	Within two weeks of trigger point being met.	Operational and management measures reviewed, catch data analysed and research efforts assessed.	Dependent upon the trigger point that has been met, other contingency measures may need to be implemented in conjunction with a review.
Any trigger point met	Additional observer trips to monitor adherence to the Plan and animal handling protocols.	As many observer trips as deemed necessary to discount poor operational conduct as a reason for meeting trigger point.		Dependent upon the trigger point that has been met, other contingency measures may need to be implemented in conjunction with additional observer trips.

5 ANIMAL HANDLING PROTOCOLS

5.1 All sharks

5.1.1 Assessing the status of animal when first found on the line

Assess the status of the shark and the potential risk to handlers and/or the shark (e.g. is it too vigorous to handle/is it too weak to handle).

Sharks' life status should be assessed according to the following standardised definitions and the condition code (1-4) of each shark shall be recorded in the appropriate data sheet:

(1) Lively, maybe (but not necessarily) swimming against capture gear/away from vessel.
(2) Sluggish but able to swim slowly and maintain itself upright, possibly some light blood loss.
(3) Very sluggish, unable to swim effectively or maintain itself upright, maybe (but not necessarily) moderate to heavy blood loss.
(4) No visible sign of life, may not exhibit bite or blink reflexes, may exhibit rigor mortis (often whole body stiffness).

Reflexive responses can be tested by putting a suitable object in the shark's mouth and tapping it's teeth/gums with it and gently tapping the shark's eyeball with a finger.

While dead and moribund sharks are still capable of causing injuries during handling, sharks in conditions (1) and (2) should be handled with particular caution.

5.1.2 Retrieval of sharks

The methods for retrieving sharks from the water will depend upon vessel specifications, design and capacity of lifting equipment, size and condition of the shark, number of personnel, weather conditions etc. While it is therefore impossible to specify how a shark should be retrieved, the following issues shall be explicitly considered and addressed in determining how to retrieve a shark:

- Can the shark be safely lifted from the water (taking account of lifting capacity, stability, weather, etc.)?
- How/where can the shark be lifted to minimise the use of lifting gear and time spent holding the shark under tension?
- How will the shark be supported as it is lifted (sling, bridle, multiple ropes, etc.)? To avoid further injury, sharks should not be lifted by lines attached to the hook or by a single tail rope (which is likely to damage the spinal cord).
- Safe above-head lifting procedures should be followed at all times and in due consideration of weather and vessel stability conditions.
- Sharks should be left in the water while preparations for lifting are made. The shark should only be brought alongside when all recovery equipment is ready for attachment.
- Retrievals should be conducted as quickly as it is safe to do so, for both the crew and the shark.
- Once on board, sharks should be positioned as close to their exit route as possible. Measures to ensure the shark does not prematurely exit the vessel must be in place (e.g. transom/gunwale doors secured, restraint lines securely attached etc.).
- Shark should be placed so that hook is clearly visible and available for removal.
- Sharks should only be located in deck areas with adequate space for crew to work safely and with multiple exit routes if the shark moves.

5.1.3 Basic life-support on board the vessel

- Prior to undertaking any further activity, cover the shark's head with a large wet cloth to reduce visual stimulation and reduce the chances of the shark moving.
- Gills should be irrigated with ambient temperature seawater, preferably by inserting deck-hose (or similar) in the mouth and pointing towards gill openings on one side. Avoid pointing hose directly down the throat or inserting too far (irrigating the stomach will compromise the shark's survival and can complicate release).
- If internal irrigation is not possible, gill slits should be uncovered and externally-irrigated.
- These measures should not delay measurement, any tissue sample collection, hook removal, release or euthanasia by more than a few seconds. If basic life support measures are not possible or likely to take more than a few seconds, hook removal and release or euthanasia should be undertaken as swiftly as possible (additional crew can continue to attempt basic life support while other action is undertaken).

5.1.4 Removing the hook

- Once all measurements and any tissue samples have been taken (see Section 6), the hook shall be removed as quickly and safely as possible so as to minimise additional injuries to the animal.
- If the hook is removed by pushing it through the entry-hole, the barb and hook should be aligned as much as possible with the existing hole to prevent further injury.
- Large long-nose pliers, metal bars or customised de-hooking devices can assist in applying necessary force to the hook inside the shark's mouth.
- In some cases, it may be better to un-shackle the hook from the chain and force the hook's eye through the entry hole. If this is undertaken, the eye should be aligned as much as possible with the existing hole to prevent further injury.

5.1.5 Determining whether to release or euthanase sharks

When determining whether a shark is in a satisfactory condition to be released, once the hook and lifting equipment (if applicable) have been removed, the shark should be reassessed against the condition code definitions given at 5.1.1.

- Sharks in condition (1) should be released as swiftly as possible to maximise their chance of survival.
- Sharks in condition (2) may benefit from revival efforts but their release should not be conditional on recovery attempts.
- Sharks in condition (3) should usually only be released if some attempt can be made to revive them.
- All sharks in condition (4) should be euthanased.

Additionally, in deciding whether to release or euthanase a shark, consideration should be given to the nature, number and severity of its injuries. In making this decision though, it should be recognised that sharks are able to survive fairly significant and extensive injuries (e.g. full muscle-depth penetrating injuries, loss of fins, eyes and claspers (external male sex organs)).

5.1.6 Determining release condition

Where an animal is released, it's condition should be recorded according to the following criteria:

(1) Swims away strongly AND little / no blood loss.
(2) Swims away slowly, appears disoriented, may (but not necessarily) spend some time swimming at the surface OR heavy blood loss.
(3) Swimming very weakly or not at all, may float belly-up on the surface or sink.

5.1.7 General guidelines for in-water recovery assistance

During capture, restraint, removal and release, sharks accumulate lactic acid in muscle tissue from similar biochemical processes that cause muscle cramps in humans. As lactic acid is only eliminated through aerobic respiration, assisting sharks to oxygenate anaerobic tissues can greatly

improve their chances of survival. In-water recovery assistance can be given by supporting the shark once it is returned to the water and preferably holding it into water flow. This can be achieved by securing the shark to a vessel as the vessel slowly makes way (depending on how it is secured, speed should not exceed 1-2 knots).

However, if the shark is not suitably secured and supported as the vessel makes way, if additional injuries are inflicted in the process, or if the shark is released with recovery equipment (e.g. ropes) still attached, recovery assistance can be highly detrimental to the shark's survival chances.

Recovery assistance should therefore only be attempted by experienced operators, with appropriate equipment, from suitable vessels and within safe weather and vessel stability constraints.

5.1.8 If euthanasia is required

In determining whether euthanasia is required it is necessary to consider the following:

- Is the shark a target species and ≥300cm Total Length.
- Do wounds from hooking or entanglement on the line indicate a level of trauma that will make post release survival unlikely (see 5.1.5) e.g. a condition assessment of (3) (when recovery assistance cannot be provided) or (4) (see 5.1.1).

If euthanasia is deemed necessary follow instructions at Section 5.2.

5.2 Euthanasia

5.2.1 Priorities

Euthanasia of animals should be carried out giving due consideration to 1) human safety, 2) animal welfare and 3) practicality, in order of priority.

5.2.2 Firearms

Firearm-based euthanasia methods have been demonstrated to be humane, rapid, cost-effective and safe (Øen and Knudsen 2007). While the most appropriate protocols for humane euthanasia of sharks are defined here, it is acknowledged that there will always be some animals that will survive the primary killing attempt, regardless of the method employed or precautions taken (Øen and Knudsen 2007).

Firearms should be used as the primary method to euthanase sharks when:

- The shark is in the water and well-secured to the boat.
- The centre-line of the top of the head is at the surface (under no more than 5 cm of water).
- There is no doubt that either the shark is a target species of ≥300cm Total Length that does not need to be brought on board to be accurately measured or is a non-target shark that will not survive release.
- The firearm can be used without risk to the crew of the vessel, spectators, other marine life, etc.
- The firearm can be used at close range.

If it is considered unsafe to discharge a firearm for any reason, then euthanasia should be delayed until is considered safe to act.

5.2.3 Personnel

A minimum of two people are required for the euthanasia process:

1) The shooter, responsible for euthanasia of the animal.
2) The overseer, responsible for ensuring that all onlookers are at a safe distance from the procedure.[7] The overseer, as far as possible, should direct any person/s to move away from the vessel prior to any shots being fired.

5.2.4 Recommended aim points

Shooting should always be directed at the dorsal surface of the animal aiming towards the back of the head, mid-way between the eye and the first gill slit.

As the precise location of the chondocranium probably varies between species, this is a guide only and even if the shot is accurately-aimed, it is not guaranteed to hit the brain.

5.2.5 Repeat shooting

If there is any doubt about hitting the target with one shot, then consideration should be given to firing three carefully placed shots in a line through the target area (DPaW 2014).

If there is ever doubt as to whether the animal is dead, follow-up shooting must always be employed (DPaW 2014).

5.2.6 Confirming death

To provide a reliable indication that a euthanased animal is dead assessment of the reflex activity of the shark should be undertaken (see section 5.1.1).

5.2.7 Non-shark species

Record the species and approximate size where possible.

Contact the DoF Operations Manager as soon as possible. The DoF Operations Manager will seek advice from experts at DoF or DPaW depending on the animal involved.

Training in the handling of non-shark species will be provided by DoF and DPaW as part of the pre-operational training.

Deceased marine mammals and reptiles must be returned to shore for collection by DPaW officers in accordance with conditions of the Licence to Take Fauna for Public Purposes issued under the WC Act.

5.3 Occupational Health and Safety

5.3.1 Firearms

Ensure that basic safety standards are observed at all times. Only load firearms once all onlookers are at a safe distance.

5.3.2 Physical injury from the animal

Ensure that animals are adequately restrained at all times during handling. All injuries, even superficial should be treated immediately to prevent infection and promote healing.

[7] Note the Department of Transport exclusion zone will be in place to prohibit vessels from approaching, and swimming, within 100m of the drum lines.

5.4 Marine mammal entanglement

The risk of a whale becoming entangled in a drum line is low, and even lower between the months of November and April. However, should an entanglement be identified, the DoF Operations Manager is to be notified immediately who will in turn liaise with the disentanglement team at DPaW.

Due to the high risk, dangerous and unpredictable nature of disentanglement operations, disentanglement procedures should not be attempted without the assistance of the disentanglement team at DPaW.

In line with the training provided prior to the commencement of operations, the West Coast Rock Lobster Managed Fishery Code of Practice for whale entanglements (considered industry best practice in responding to whale entanglements) should be followed. This requires continuous monitoring of the entanglement situation, with due regard for the safety of the vessel and the whale, until assistance teams arrive.

6 OPERATIONAL PROTOCOLS

6.1 Training

Experts from DoF, DPaW and other relevant agencies and institutions will provide training prior to the commencement of operations each year. Training will be provided on the following as a minimum:

(1) animal handling and condition assessment (see Section 5);
(2) baiting and setting drum lines;
(3) drum line maintenance;
(4) shark species identification;
(5) hook placement;
(6) assessing animal depredation levels;
(7) techniques for accurately measuring captured animals;
(8) identifying the sex of a shark;
(9) fitting of fin tags (conventional and satellite);
(10) techniques for obtaining tissue samples;
(11) photographic requirements;
(12) taking water quality readings; and
(13) data recording and notification processes.

The following protocols should be undertaken in the order presented where feasible and practical.

6.2 Drum line maintenance

(1) Each drum line to be checked for damage, loss, wear and tear or signs of vandalism as part of daily patrols.
(2) Any gear to be repaired or replaced as required and data records completed.
(3) DoF Operations Manager to be notified of requirements for additional or replacement gear.
(4) Vandalism to drum lines to be recorded and reported immediately to the DoF Operations Manager.

6.3 Species identification

Using the Western Australian and New South Wales field identification guides provided, and any other material deemed relevant to identifying shark species, identify the species of shark, or other marine fauna, as appropriate. Where a species cannot be accurately identified in a timely manner, the condition of the animal should not be compromised. Photographs should be taken in accordance with the directions provided at section 6.10 for further analysis and the species recorded as accurately as possible e.g. whaler shark black tip on dorsal fin, or alternatively as 'unknown'.

6.4 Hook placement

Observations should be made for each catch of the hook placement and should be recorded as follows:

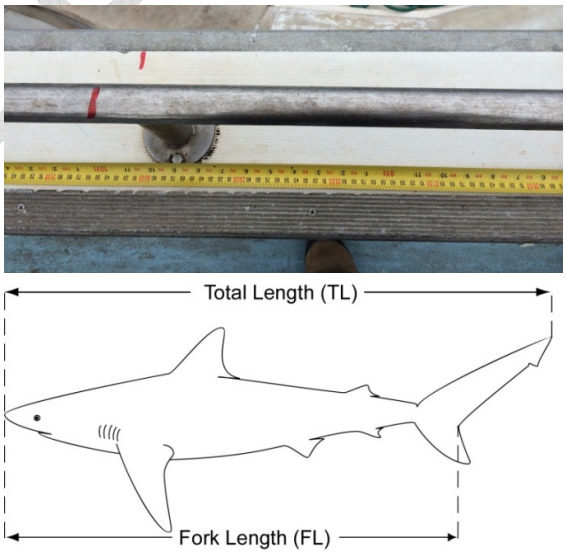
Hook placement	Description
Clean-hooked	hook around outside of the mandible
Lip-hooked	hook through skin around the mouth only
Jaw-hooked	hook through the mandible
Palate-hooked	hook through roof/floor of mouth but not involving jaw structure
Gill-hooked	hook through/around/caused damage to gill arches
Throat-hooked	hook embedded in throat; visible through mouth
Gut-hooked	hook embedded behind throat; not visible through mouth. In some cases, sharks may evert stomachs with hook through them
Jagged	hook embedded in skin; often in fin
Other	

6.5 Depredation

Observations should be made on the level of depredation (tissue loss or damage) of the catch on the line e.g. <25%, 25-50%, 50-75%, >75%, along with descriptive comments (e.g. single/multiple bites to mid-trunk, tail missing etc.) with relevant photos taken and recorded.

6.6 Measuring

An initial Total Length (TL) estimate is to be made (i.e. is it clearly <3m TL or clearly >3m TL) before the shark is removed from the water. This can be done by using guiding markers on the side of the vessel from a fixed point (such as the pot tipper, scupper, etc.)



Once the shark's fate has been decided, accurate length measurements shall be taken to the nearest centimetre, according to the methods at 6.6.1 to 6.6.3. All measurements are to be taken with flexible tape measures, however, as Total Length of sharks less than approximately 180cm TL can be more accurately measured using measuring boards fitted with embedded rulers and fixed end plates, these are also acceptable. Any other methods and equipment for measuring sharks will require approval by a DoF specialist shark research scientist.

6.6.1 Total length

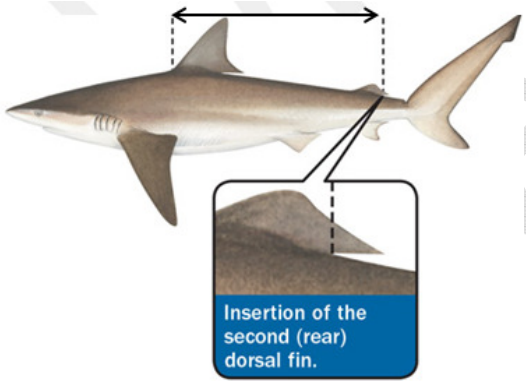
Total length (TL) is measured as a straight line from the tip of the snout to a line perpendicular with the tip of the upper lobe of the caudal fin, with it held in a 'natural' position. Total lengths should not be measured around the curvature of the body. Where the animal is within 10cm either side of the target length (i.e. 290cm - 310 cm TL), three measurements should be recorded and the average taken.

6.6.2 Fork length

Fork length (FL) is measured as a straight line from the tip of the snout to the rear margin of the fork of the tail, with it held in a 'natural' position. Fork length should not be measured around the curvature of the body.

6.6.3 Interdorsal length

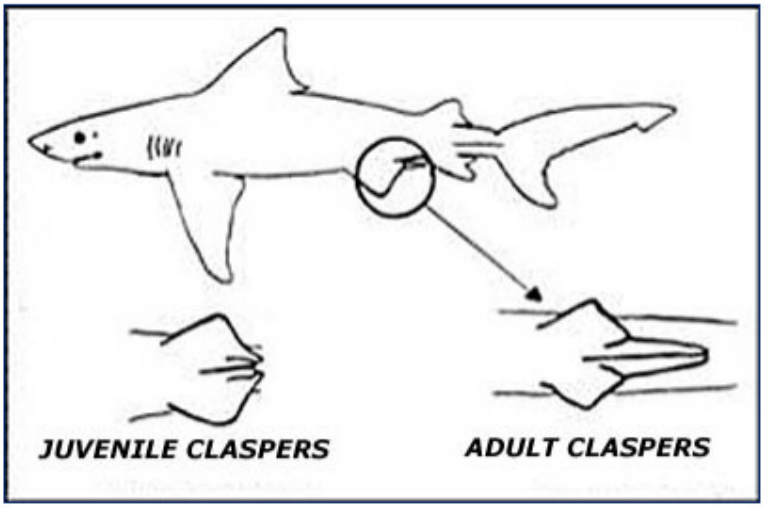
Interdorsal length should be measured as the horizontal straight-line distance between the origin (forward-most point of attachment) of the first dorsal fin and the insertion (rear-most point of attachment) of the second dorsal fin.

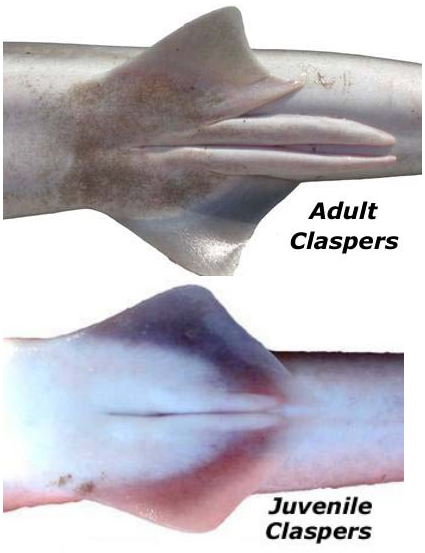


6.7 Sexing

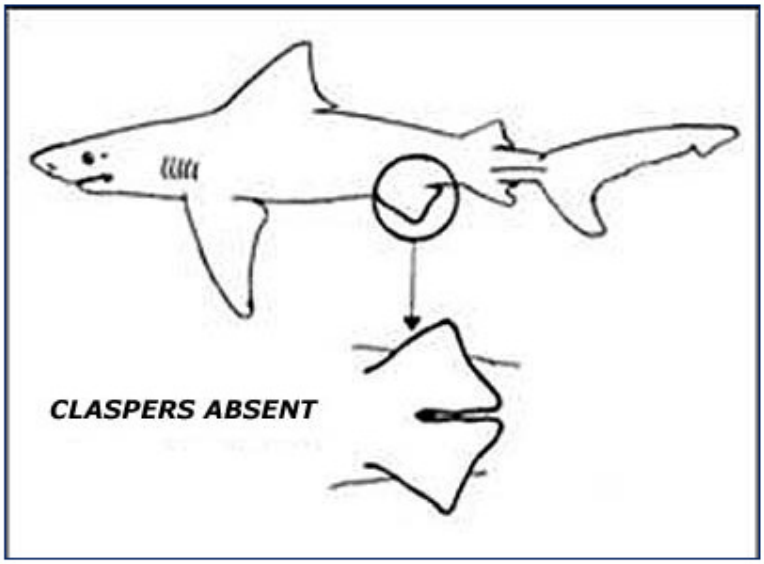
The sex of each shark shall be determined and recorded, according to the presence (male) or absence (female) of claspers on the inner parts of the pelvic fins. NB. Immature males' claspers can be small and inconspicuous, so pelvic fins need to be carefully checked to confirm presence/absence.

MALE





FEMALE



6.8 Tagging

(1) Uniquely numbered kangaroo tags (supplied) are to be fitted to the dorsal fin of every shark that is dead or euthanased.

(2) Uniquely numbered conventional fin tags (jumbo rototags or similar) (supplied) to be fitted to the posterior third of the first dorsal fins of sharks being released.

(3) As per Section 4.6.1:

- White sharks that are less than three metres total length and assessed as being in either condition (1) or condition (2) (see 5.1.1) will be fitted with fin mounted satellite tags.
- Fin mounted satellite tags will be fitted to the first 20 tiger sharks that are captured in the metropolitan[8] MMA, are less than three metres total length, and assessed as being in either condition (1) or condition (2) (see 5.1.1).
- Fin mounted satellite tags will be fitted to all bull sharks that are less than three metres and assessed as being in either condition (1) or condition (2) (see 5.1.1).

6.9 Biological sampling

6.9.1 All released sharks

Using a pair of sharp scissors, scalpel or sharp knife, a small (5mmx5mm or equivalent) piece of the dorsal fin is to be removed. The most appropriate locations for these samples to be taken from are: the fin tip, posterior margin (rear edge) and free rear tip. Fin samples will be fixed in suitable fixative (provided) and stored in containers (supplied) for later genetic analysis. Containers are to be labelled with the date, species, sex and relevant catch record number from which the sample was taken.

All samples are to be stored in the main container (supplied) for subsequent transfer to DoF.

6.9.2 White sharks – alive and released

For white sharks which are released undertake the following:
(1) attach fin tag as per 6.8 (2) or 6.8 (3) (depending upon the condition of the animal etc.); and
(2) fin clip as per 6.9.1.

In addition and, if possible without removing the shark from the water, the following may be undertaken by trained and properly-equipped personnel:

(1) surgical implantation of an internal acoustic tag.

6.9.3 White sharks – deceased or euthanased

For white sharks which are euthanased as part of the Program, the following samples should be taken with due regard to vessel and crew safety and logistical practicality, in descending order of preference:

(1) The whole carcass

Where the whole carcass cannot be delivered to DoF, all or some of the following sampling should be undertaken where practicable (note – training to be provided):

(1) Vertebral sample.
(2) Embryos (all).
(3) Entire jaws.
(4) Photographs of reproductive organs.
(5) Liver sample.
(6) Blood sample.
(7) Visible parasitic/commensal organisms.
(8) Genetic ('fin clip') sample at minimum.
(9) Other samples as specified by the contract manager.

In addition, the following data is to be collected where practicable:

(1) Photographs (as specified under 6.10).

[8] Tagging tiger sharks in the metropolitan region offers greater access to DoF staff and supplies should they be required.

(2) Clasper length (pelvic fin insertion to tip) and degree of calcification.
(3) Testes stage.
(4) Presence/absence of running spermatozoa.
(5) Uterine stage, number of embryos, embryo sexes (where visible).
(6) Dietary data (stomach fullness, individual contents to lowest identifiable taxa and digestive state).

6.10 Photographs

The following photographs should be taken of every shark that is caught on a drum line:

(1) Side-on, full body length (photo should be taken from as close as possible to perpendicular to the shark's longitudinal and dorso-ventral orientation).
(2) Underside (ventral view) of the head (photo should be taken from as close as possible to perpendicular to the shark's midline and longitudinal orientation, showing:
    a. Tip of snout,
    b. Nostrils (and barbels if present),
    c. Mouth
    d. Ventral base of first gill-slit
    e. Inter-dorsal ridge
(3) One photo from as close as possible to perpendicular to the shark's longitudinal orientation and lateral orientation.
(4) One photo from as close as possible to perpendicular to the shark's longitudinal orientation and 45° to its lateral orientation.

6.11 Water quality

Using the handheld water quality recording device[9] take the following readings at 5m intervals through the water column, and on the sea bed, whenever a drum line is checked, irrespective of whether anything has been caught:

(1) water depth (m)
(2) water temperature (°C)
(3) dissolved oxygen (mg/L)
(4) salinity (PSU)

6.12 Notification of catch

(1) If a non-target shark that is >2.5m is to be released the DoF Operations Manager must be notified to ensure that the relevant agencies (e.g. SLSWA) are advised where appropriate.
(2) DoF Operations Manager to be notified of all target species ≥3m TL caught.
(3) DoF Operations Manager to be notified of all white sharks captured irrespective of size.
(4) As per performance indicator 6.4, the OEPA, DPaW and DoE to be notified of all white sharks captured within 24 hours of the capture.
(5) DoF Operations Manager to be notified of the capture of any non-shark species.
(6) As per performance indicator 6.5, the OEPA, DPaW and DoE to be notified of the capture of any marine mammal or turtle within 24 hours of the interaction. In the event the marine mammal or turtle dies, the animal must be retained on board for transfer to DPaW.

6.13 Record keeping

Data, including photographs, of all animals caught on drum lines should be collected and recorded *without materially or reasonably compromising the survival prospects of those animals*. All data (including photographs) should include sufficient detail to identify the capture's time, place and species.

[9] Exact make and model to be confirmed but will most likely be similar to a YSI Professional Plus model or an RBR XR-620 equivalent.

Data records for each day of operation will be maintained and provided to the Proponent on a weekly basis. Data records will include the following:

Date
Region (metro/south west)
Location (e.g.Floreat/Quindalup)
Drum line number (e.g. FL3)
Drum line GPS
Time drum line inspected
Drum line damage/vandalism/wear and tear/loss
Bait type
Whole/partial
No. of pieces
Age when checked (e.g. when was the bait put on the hook)
Catch (Y/N)
Species
Sex
Condition on the line (1-4)
Hooked (placement)
Depredation (tissue loss or damage) (%)
Total length (cm)
Length noted as approximate (Y/N)
Fork length (cm)
Interdorsal length (cm)
Final condition (1-4)
Blood loss
Other injuries
Action
Release status (1-3)
Subsequent action (e.g. disposed/retained)
Use (e.g. research)
Existing tag (e.g. research tagging equipment)
New conventional fin tag number
New kangaroo tag number
New acoustic tag number
New satellite tag number
Vial number (for genetic samples)
Photo numbers
Water temperature (°C)
Water depth (m)
Dissolved oxygen (mg/l)
Salinity (PSU)
Disposal GPS
Catch reported to DoF Operations Manager (Y/N)
Date bait purchased
Type of bait purchased
Amount (kg)
Cost ($)
Vessel Name
Start time
Start hours
End time
End hours
<u>In Response To A Shark Threat or Incident</u>
Date
Region (metro/south west)

Time of notification
Time of drum line deployment
Location of drum line deployment (GPS)
Bait type
Whole/partial
No. of pieces
Time returned to 1km offshore
Catch (Y/N)
Species
Sex
Condition on the line
Hooked (placement)
Depredation
Total length (cm)
Length noted as approximate
Fork length (cm)
Interdorsal length (cm)
Final condition
Blood loss
Other injuries
Action
Release status
Subsequent action (e.g. disposed/retained)
Use (e.g. research)
Existing tag (e.g. research tagging equipment)
New conventional fin tag number
New kangaroo fin tag number
New acoustic tag number
New satellite tag number
Vial number (genetic samples)
Photo numbers
Water temperature (°C)
Water depth (m)
Dissolved oxygen (mg/l)
Salinity (PSU)
Disposal GPS
Catch reported to DoF Operations Manager (Y/N)

Additional data or information may be requested to be recorded by the Proponent at any time.

6.14 Disposal site

Sharks must be taken offshore and disposed of within State waters (i.e. within 3 nautical miles) and away from populated areas. Sharks must not be disposed of within any proposed or gazetted marine recreation or sanctuary zones as designated under the *Conservation and Land Management Act 1984*.

7 RESPONDING TO AN IDENTIFIED SHARK THREAT OR INCIDENT WITHIN AN MMA

This Section is currently under review

The following process is to be followed in the event that a shark is considered to be posing a threat to public safety or following a shark attack within an MMA.

A decision on the deployment of resources in response to an identified shark threat or incident within an MMA will be made by the DoF Operations Manager.

7.1 Shark sightings

The following must be confirmed before initiating a response to a shark sighting within an MMA:

1. Report has been made within one hour of the sighting and response able to be in place within one hour of report being made.
2. Location is clear (e.g. land or ocean marker or GPS waypoint).
3. The sighting is credible. This assessment can take into account the source of the report (Surf Life Saving WA, commercial fisher, agency vessel) or be confirmed by contacting the individual reporting the sighting.
4. The shark is believed to have a length of three metres or greater and be within 1km of the shore.
5. Where possible the shark species is identified as a target species under the Program.
6. The DoF Operations Manager is satisfied that public safety is of concern (beach/es is/are occupied, shark remains in the vicinity, shark is close to shore etc.).
7. The Land Manager (or delegated authority) must agree to, and have capacity to give effect to, beach closure for the period of temporary drum line deployment.
8. In the event that the Land Manager will not or cannot agree to beach closures, the deployed vessel will still attend and deploy temporary drum lines.

An assessment of the circumstances should also consider whether there is a plausible reason to believe the shark sighting is likely to be temporary. In some circumstances there may be prevailing conditions such as the presence of a whale carcass, or seasonal fish aggregations which explain the presence of a shark. An assessment should be made as to whether the risk under these circumstances can be mitigated through other measures, such as beach closures, media announcements and close monitoring until the risk is considered to have passed.

Clarification on the following will assist in the confirmation and initiation of a response:

- Person reporting the sighting can explain how they determined the length of the shark and the detail is plausible.
- Length can be gauged in comparison to an object e.g. the reporter's water vessel or other visual marker.
- Person can explain how they determined distance from beach and the detail is plausible.
- Person can describe any patterns or particular features of the shark's body, assisting in species identification.
- Environmental conditions are favourable to water visibility.
- Sighting can be verified by another person (e.g. Surf Life Saving WA aerial patrol).

The following is the procedure to be followed to initiate a response to a shark sighting within an MMA:

1. Identify resources to support deployment operation (e.g. vessel availability, beach closures, aerial support).
2. Obtain verification that beaches have been cleared as appropriate.

3. Liaise with DPaW with regard to deployment in a marine protected area.
4. The deployed vessel attends and sets up to five baited drum lines.
5. The drum lines must be removed from the water no more than one hour after initial deployment.
6. Temporary drum lines in response to a sighting within an MMA are to be deployed for a maximum of one hour per response and monitored closely in that time. Any subsequent sightings will constitute a new response.

7.2 Shark incident

The following must be actioned in response to a shark incident within an MMA:

1. Following DoF standard operating procedures, a shark incident is confirmed to have taken place within the geographic and temporal extent of an MMA.
2. Resources identified to support deployment operation (e.g. vessel availability, beach closures, aerial support).
3. Verification obtained that beaches have been cleared as appropriate.
4. Liaison with DPaW with regard to deployment of temporary drum lines in a marine protected area complete.
5. The deployed vessel attends and sets up to five baited drum lines.
6. Drum lines are to be closely monitored during daylight hours for a maximum of seven days (per incident).
7. In considering a response to a fatality or a marine search and rescue (in the case of a missing body, or body part) the deployed vessel is to defer to DoF, WAPol or any other agency unit when requested to do so in line with the DoF standard operating procedures for responding to a shark incident.

In responding to an identified shark threat or incident within an MMA the Operational Environmental Management Plan must be adhered to at all times, where practicable.

The notification procedures detailed at 6.12 are to be followed in the event of any catch relating to the deployment of temporary drum lines in an MMA.

8 COMPLIANCE PLAN

(1) Meetings will be held with the relevant parties to ensure clear lines of communication and understanding of all operational requirements. Meetings will be held prior to the commencement of operations each year, as required throughout the operational phase of the Program and following the completion of the Program post 30 April each year.
(2) Data records (see Section 6.13) are to be provided, together with photographs, to the Proponent on a weekly basis. Data records will then be provided to DoF and DPaW on a weekly basis and to the OEPA and DoE within seven days from the end of each month of the deployment.
(3) Notification of catch rates reaching trigger points and details of contingency actions taken will be provided to the OEPA and DoE within 24 hours of meeting a trigger point.
(4) Reports will be provided to the OEPA and DoE within two months of the close of each Program season.
(5) To ensure compliance with the Plan a minimum of 10 observer trips on each vessel will be undertaken between 15 November and 30 April each year, with additional trips undertaken as required. Observers will be present on the first trip of each season on each vessel to observe the start of operations and deployment of drum lines within each MMA. The observers' role will be to observe the operational performance and ensure the objectives of the Plan are met. Observers will be officers from agencies including, but not limited to, DoE, DoF, DPaW and DPC. Reports will be completed following each observer trip in each region. Individuals from non-governmental agencies may observe operations, however must always be accompanied by an employee of a state or commonwealth agency and consideration given to workplace health and safety of the crew and those wishing to observe.
(6) The Proponent will provide training prior to the commencement of operations (see Section 6.1). Training will be provided by officers experienced in the setting of fishing gear and handling of marine animals from DoF and DPaW as well as others with expertise in the relevant areas. Training will refer to safe work methods including minimising stress to animals and safety of crew.

9 RESEARCH COMPONENT OF THE PROGRAM

Access to animals protected under the EPBC Act for research purposes will only be facilitated in association with the relevant approvals. Subject to the approvals, relevant authorisations to conduct research on protected fauna under the FRMA and WC Act will be sought at a State level.

9.1.1 Research objectives

In considering the requirements of the Commonwealth Recovery Plan for the White Shark, and opportunities to increase knowledge of all shark species, the research objectives of the Program are to:

(1) Contribute to the knowledge of the population structure and life history of sharks through the collection of tissue samples.
(2) Contribute to the knowledge of shark distribution through catch rates and catch and effort data.
(3) Contribute to the knowledge of shark movements using available satellite and acoustic tagging technologies.
(4) Contribute to the knowledge of post-release survival of target sharks.

9.1.2 Core research to be undertaken by Government

(1) Tissue samples will be collected from all white sharks and EPBC Act-listed species where practical. For white sharks that are euthanased as part of the Program this may include; fin clips or other tissue samples for genetics (as a minimum requirement) and/or vertebral samples for age and growth studies (see Section 6.9.3). For white sharks which are caught and released as part of the Program this may include; fin clips or other tissue samples for genetics (as a minimum requirement); internal acoustic tagging for movement patterns and alert systems as part of the Shark Monitoring Network; fin mounted satellite tagging for vertical and horizontal movement patterns and post-release survival and conventional fin tags for mark-recapture and age and growth studies (see Section 6.9.2). Tissue samples will be collected for other shark species where practical and appropriate.
(2) Data will be collected on bait usage in an attempt to standardise catch rates in the Program.
(3) Water quality data, including water temperature, salinity, dissolved oxygen and water depth will be collected to ascertain correlations between shark presence and local oceanographic conditions.
(4) A gear selectivity trial may be undertaken during the Program to determine the effectiveness of different size and style hooks on minimising catch of non-target species and undersize sharks. Hooks no smaller than an approximate 25/0 circle design will be used at all times.
(5) Presence data for sharks will be added to the Atlas of Living Australia where considered appropriate.
(6) Studies based on catch and effort.

9.1.3 Potential for further research by external institutions

The Program potentially offers significant opportunities for other shark research including:

(1) blood sample analysis (e.g. for lactic acid/stress on the line);
(2) genetic analysis;
(3) tagging and tracking of animals;
(4) the use of hook timers to assess survivability of animals on the lines;
(5) life history and reproduction studies; and
(6) access to tissue samples.

An invitation will be extended to research institutions to submit research proposals to be undertaken as part of the Program. Other interested parties may also submit research proposals for consideration by the Proponent.

It is anticipated that data collected as part of the three year Program will add to the knowledge of sharks in south western Western Australian waters.

In addition to research opportunities available through the Program, the Government will continue to collaborate with the Commonwealth Government to survey Western Australian waters to identify whether white shark juvenile aggregation and/or nursery areas exist within the State's jurisdiction. Identification of these areas is essential for applying novel genetic and electronic monitoring techniques to determine and monitor the status of this population. DoF's Shark Monitoring Network telemetry studies will also continue for at least the first year of the Program.

10 ADDRESSING OBJECTIVE 4 OF THE RECOVERY PLAN FOR THE WHITE SHARK

Action	Description	Performance criteria	WA Government address
4.1	Shark control programs to continue to report catches annually.	Ongoing collection and assessment of catch data.	WA Government to report on catches of white sharks within 24 hours of interaction and provide reports on catch data monthly.
4.2	Maintain the current review processes of the effect of shark control programs on the white shark.	Levels of white shark mortality/interaction during shark control activities are quantified. In areas where there is regular mortality/interaction with white sharks during shark control activities, seasonal trends and post release mortality have been monitored. Options that may facilitate a reduction in white shark captures at locations where there is regular interaction/mortality of white sharks during shark control activities are identified.	Annual reviews of the program to be undertaken and completed within two months of 30 April each year. A final evaluation of three years of catch data will be undertaken and completed by 31 August 2017. Measures taken to reduce the take of white sharks include: • a larger than standard hook • no netting system • a limited number of drum lines • twelve hour patrols of the drum lines • no deployment through the winter months when white shark presence is greatest
4.3	Where feasible and practical, undertake biological recording and sampling of white sharks caught in shark control programs.	Protocols for shark control program contractors modified to require, where feasible and practical, retention and delivery to governments and research agencies of white sharks killed in beach safety programs.	A commitment to undertake biological sampling of all white shark captured, and retention of white shark carcasses, wherever feasible and practical.
4.4	Develop a tagging program, where appropriate (including genetic sampling, where possible) for white sharks caught in shark control programs, in conjunction with new and existing programs	Tagging program developed where possible/appropriate. Released sharks tagged, and genetic sample retained where possible. Post-release mortality of released sharks monitored.	Acoustic tagging program continuing through DoF. White sharks <3m to be fitted with internal acoustic tags where trained personnel are present and able to perform the procedure safely. Genetic samples to be taken from all white sharks where possible. Fin mounted satellite tags to be applied to the dorsal fin of every white shark <3m TL to be released (where it is considered to be in a condition to be tagged and released).
4.5	Continue to evaluate alternatives to beach meshing/drum lining, including the use of non-lethal methods of alternative strategies.	Alternatives are evaluated and implemented if effective. The use of beach meshing nets and drumlines to decline as alternatives are developed.	The Government has invested $22million to 2015-16 on a broad range of shark hazard mitigation measures including: • aerial and beach patrols and jet skis through SLSWA; • beach enclosures; • DoF research including the automated Shark Monitoring network; • a Shark Response Unit; • education campaigns and material; and • $2million to applied research programs to investigate non-lethal shark deterrent and detection technologies.

11 PROGRAM REVIEW

11.1 A within season review

If enacted as a contingency measure (see Section 4.7), within two weeks of a trigger point being met, a review of the operational and management measures, analysis of catch data and research efforts for the species for which the trigger has been met is to be undertaken. The review will inform the ongoing effort of the Program to monitor and control the catch levels of the specific species to which the review relates. The report will be provided to the OEPA, DPaW and DoE within seven days of completion.

11.2 Annual review and performance report

To allow for a full consideration of the performance of the Program, an annual review will be conducted at the end of each season (e.g. post 30 April 2015, 2016 and 2017). The review will include information on catch data and catch data analyses, operational performance against the performance objectives and indicators, research collaborations, research activities and progress, and effectiveness of management measures. The review will summarise end of season catch positions against acceptable catch levels and trigger points, address any contingency measures which were taken and their effectiveness and make any recommendations for the following season. The report is to be finalised within two months of 30 April each year to allow for any changes or operational responses to be incorporated before the commencement of the next season. The annual review will be provided to the OEPA, DPaW and DoE by 30 June each year.

11.3 Final evaluation report

In addition to the annual review which will be conducted post 30 April 2017, a full evaluation of the Program following three consecutive years of operation will be conducted (e.g. post 30 April 2017). The final evaluation will provide an overall analysis of; catch data from the three years of operation; operational performance assessed against the performance objectives and indicators; effectiveness of management measures; contributions to research and significant findings or outcomes. The final evaluation report will also make recommendations for future shark hazard mitigation measures in consideration of all facets of the Government's shark hazard mitigation strategy and suitable alternative and/or complementary technologies that may have become available. The report is to be finalised two months following the completion of the annual review and provided to the OEPA, DPaW and DoE by 31 August 2017.

12 REFERENCES

Bruce, B.D. and Bradford, R.W. (2013). Protocols for capturing and tagging juvenile white sharks in near-shore waters. CSIRO, Australia.

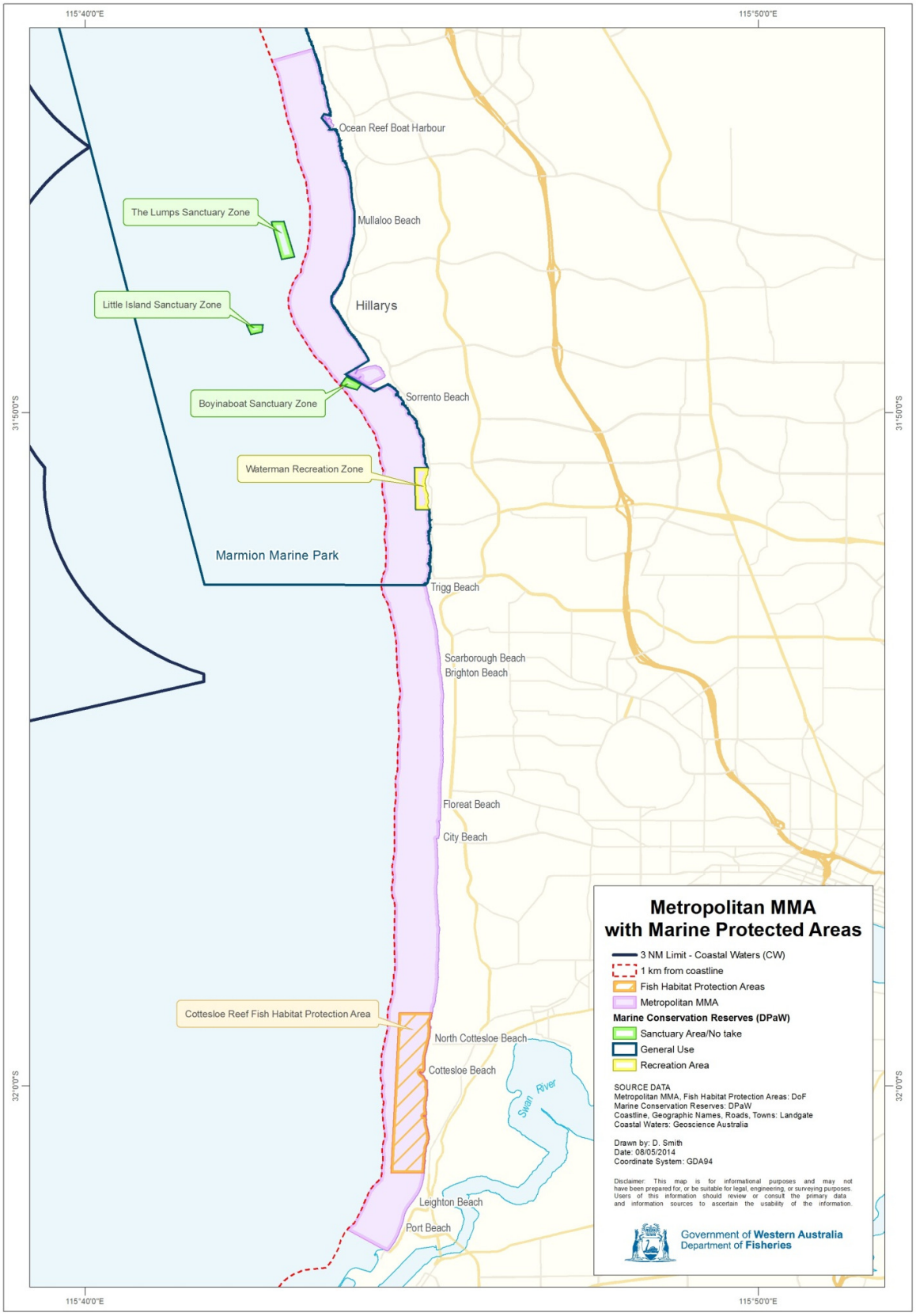
DPaW (2014). Euthanasia of small stranded cetaceans using firearms. Standard Operating Procedure No. 15.5. Department of Parks and Wildlife, Science and Conservation Division, Nature Protection Branch.

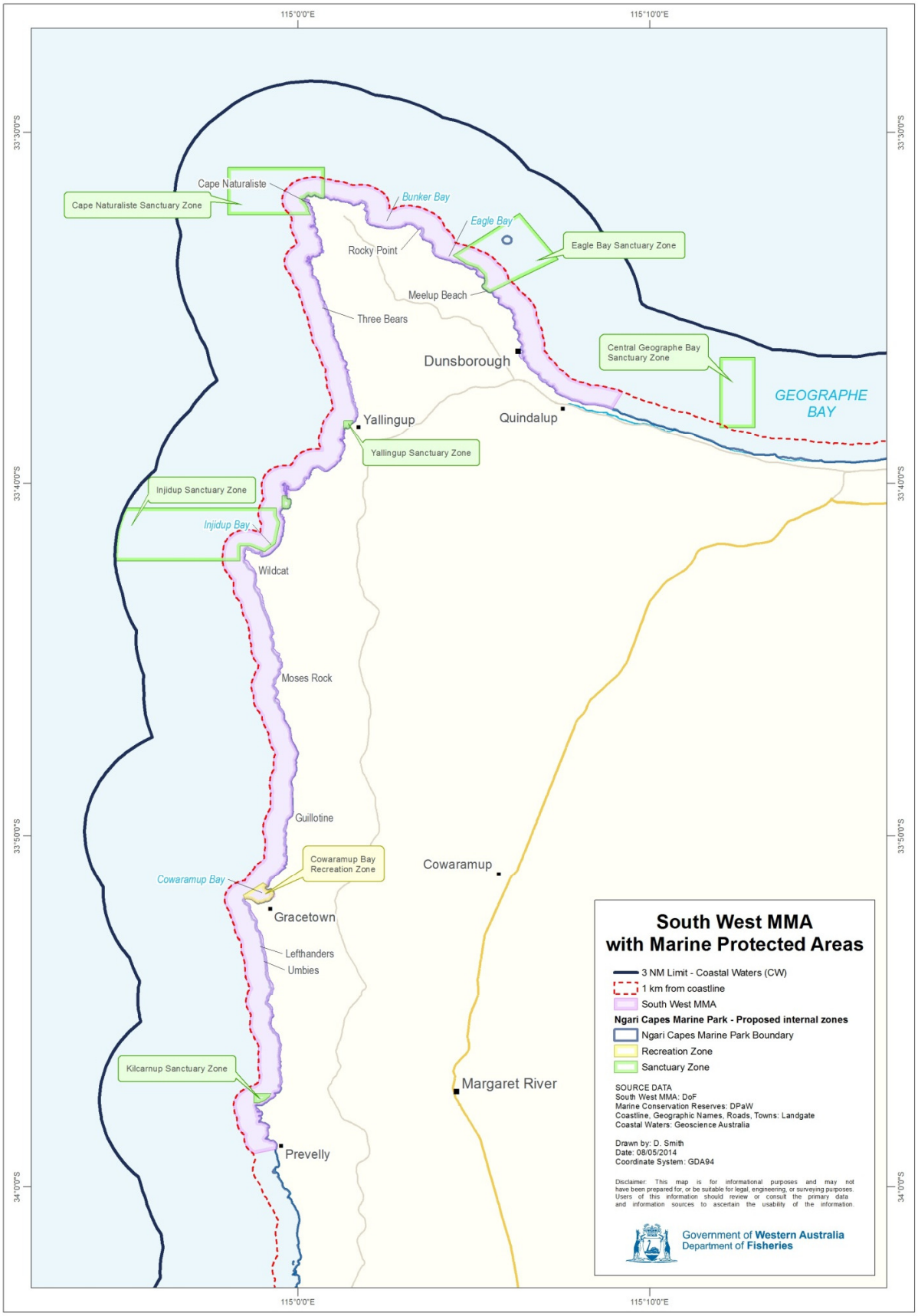
Gallagher, A.J., Serafy, J.E., Cooke, S.J. and Hammerschlag, N. (2014). Physiological stress response, reflex impairment, and survival of five sympatric shark species following experimental capture and release. *Marine Ecology Progress Series* **496**:207-218

Øen E.O. and Knudsen S.K. (2007). Euthanasia of whales: the effect of .375 and .485 calibre round-nosed, full metal-jacketed rifle bullets on the central nervous system of the common minke whale. *Journal of Cetacean Research and Management* **9**(1):81-88

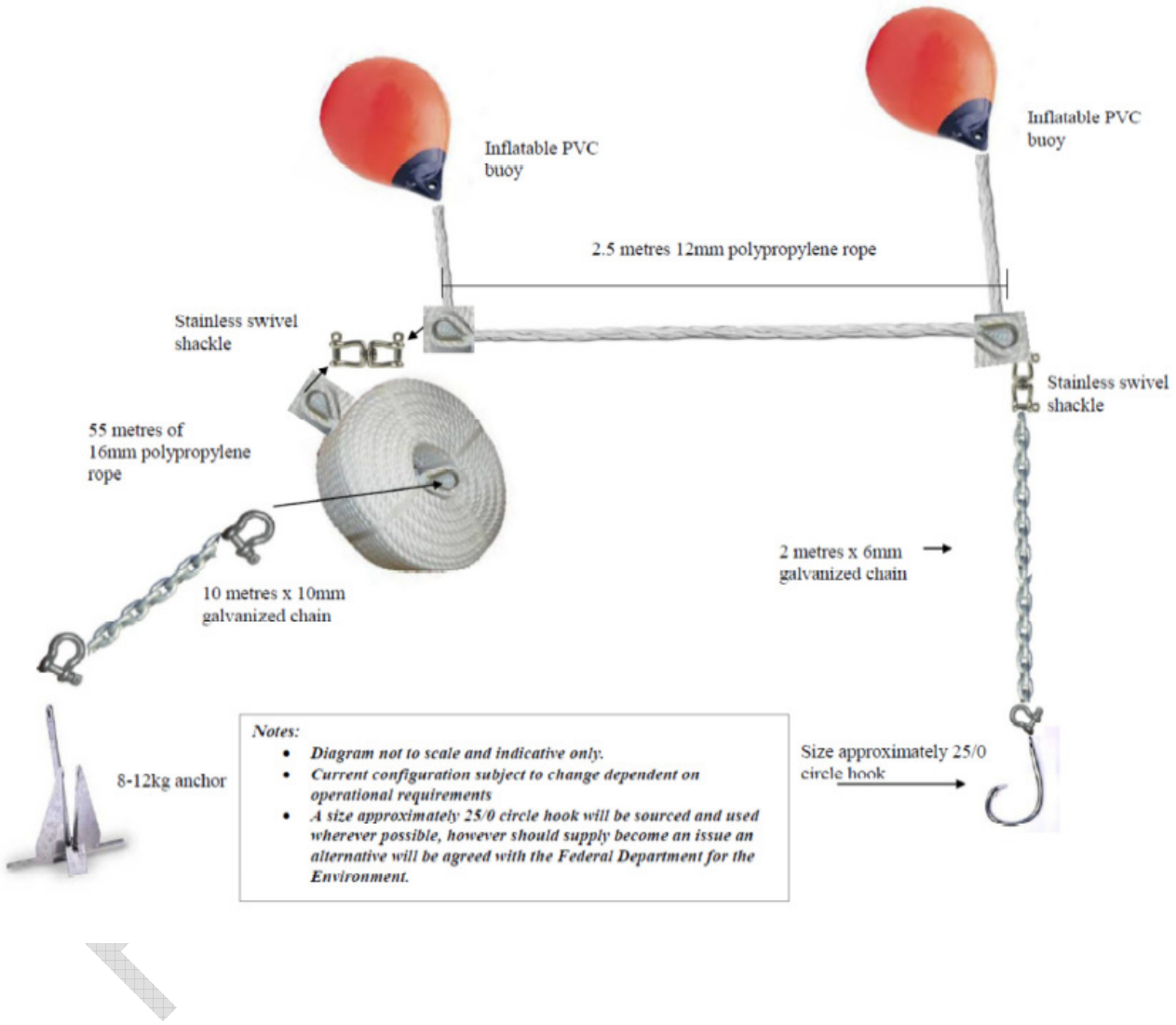
13 ATTACHMENTS

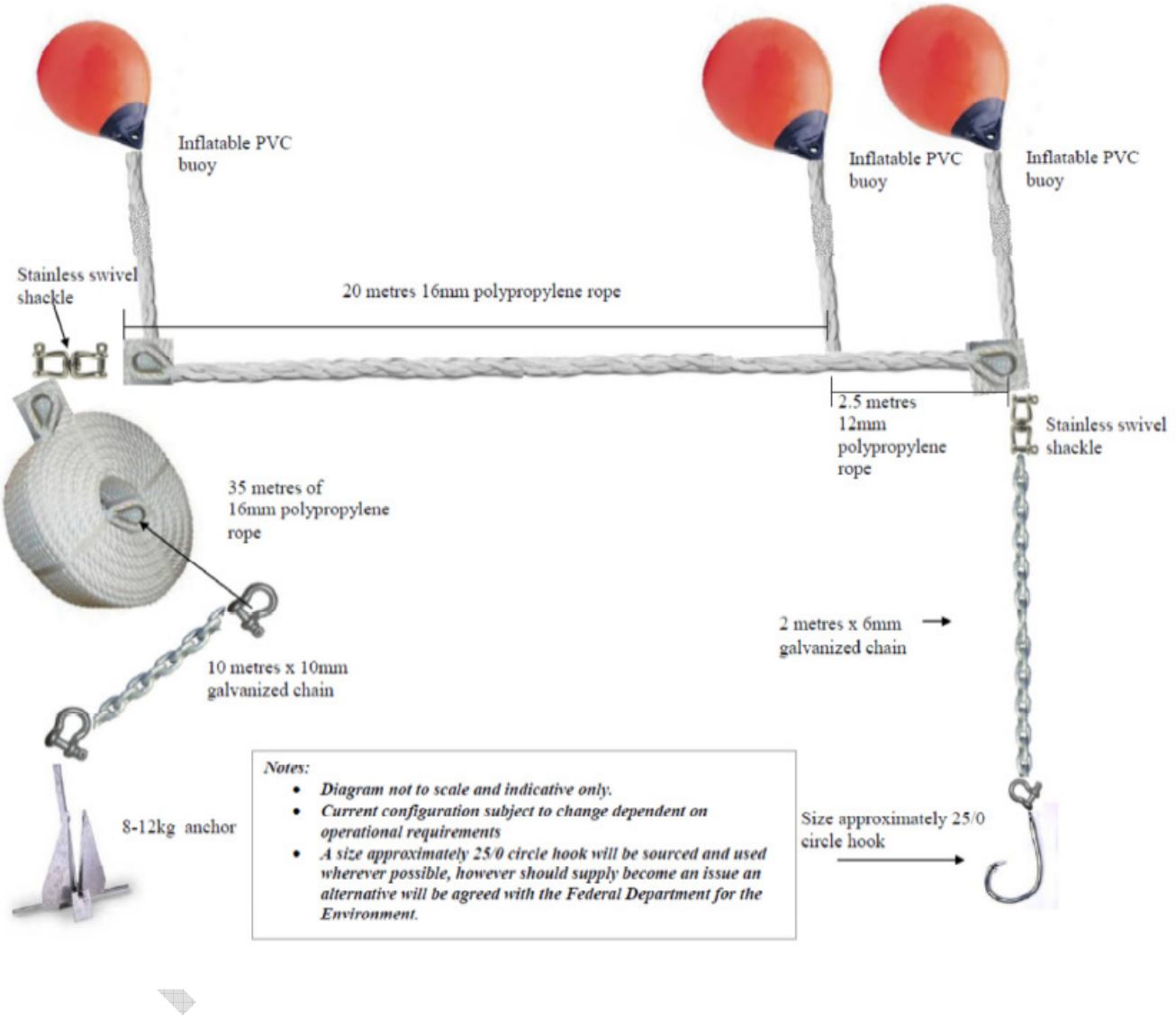
13.1 Location and extent of the MMAs




115°0'0"E
115°10'0"E
33°30'0"S
33°40'0"S
33°50'0"S
34°0'0"S
Cape Naturaliste
Cape Naturaliste Sanctuary Zone
Bunker Bay
Eagle Bay
Eagle Bay Sanctuary Zone
Rocky Point
Meelup Beach
Three Bears
Dunsborough
Central Geographe Bay Sanctuary Zone
GEOGRAPHE BAY
Yallingup
Quindalup
Yallingup Sanctuary Zone
Injidup Sanctuary Zone
Injidup Bay
Wildcat
Moses Rock
Guillotine
Cowaramup Bay Recreation Zone
Cowaramup Bay
Cowaramup
Gracetown
Lefthanders
Umbies
Kilcarnup Sanctuary Zone
Margaret River
Prevelly
South West MMA with Marine Protected Areas
3 NM Limit - Coastal Waters (CW)
1 km from coastline
South West MMA
Ngari Capes Marine Park - Proposed internal zones
Ngari Capes Marine Park Boundary
Recreation Zone
Sanctuary Zone
SOURCE DATA
South West MMA: DoF
Marine Conservation Reserves: DPaW
Coastline, Geographic Names, Roads, Towns: Landgate
Coastal Waters: Geoscience Australia
Drawn by: D. Smith
Date: 08/05/2014
Coordinate System: GDA94
Disclaimer: This map is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.
Government of Western Australia
Department of Fisheries

13.2 Drum line configurations




Inflatable PVC buoy
Inflatable PVC buoy
Inflatable PVC buoy
Stainless swivel shackle
20 metres 16mm polypropylene rope
2.5 metres 12mm polypropylene rope
Stainless swivel shackle
35 metres of 16mm polypropylene rope
2 metres x 6mm galvanized chain
10 metres x 10mm galvanized chain
8-12kg anchor
Size approximately 25/0 circle hook
Notes:
Diagram not to scale and indicative only.
Current configuration subject to change dependent on operational requirements
A size approximately 25/0 circle hook will be sourced and used wherever possible, however should supply become an issue an alternative will be agreed with the Federal Department for the Environment.

13.3 Summary of the risk analysis, risk scores and risk evaluations for the Program

Component	Risk Analysis	Risk Scores	Risk Evaluation
TARGET SPECIES			
White shark	With catch levels expected to be < 10 individuals per year there is only a **remote likelihood** (Likelihood Level 1) that this would have a minor level of consequence (Consequence Level 1) on the total size, or migratory patterns, of the southwestern Australian population of white sharks.	1	Negligible
Tiger shark	If the levels of capture of tiger sharks remain within the expected levels (~40 tonne per year) and assuming high levels of release mortality rates, it would be **possible** (Likelihood Level 3) for the Proposal to generate a **minor consequence** (Consequence Level 1).	3	Low
Bull shark	Expected capture rate is none to a few individuals each year. Therefore there is a **high likelihood** the Proposal will have **no impact** (Consequence Level 0).	0	Negligible
NON-TARGET SPECIES			
Dusky shark	If the annual level of capture and mortality of large dusky sharks remains in the revised expected range (< 10), there is now only a **remote likelihood** (Likelihood Level 1) of **a minor level of impact** (Consequence Level 1).	1	Negligible
Other non- listed elasmobranchs	There is a **high likelihood** (Likelihood Level 5) that few individuals from each of the other species of sharks and rays will be caught and therefore generate **negligible impacts** (Consequence Level 0).	0	Negligible
Demersal scalefish	There is a **high likelihood** (Likelihood Level 5) that **no demersal scalefish** will be caught and also that few, if any, other finfish species will be caught (Consequence Level 0).	0	Negligible
PROTECTED OR LISTED SPECIES			
Grey nurse shark	There is a **high likelihood** that no grey nurse sharks will be caught and, even if a few are caught they will most likely be able to be released alive resulting in **no** or **negligible impacts** (Consequence Level 0).	0	Negligible
Shortfin mako shark	There is a **high likelihood** that the Proposal will have a **negligible impact** (Consequence Level 0) on the shortfin mako shark population of Australia.	0	Negligible
Other listed elasmobranchs	There is a **high likelihood** (Likelihood Level 5) that no whale sharks, manta rays or other listed species of sharks and rays will be caught resulting in **no** or n**egligible impacts** (Consequence Level 0).	0	Negligible
Seals and sea lions	With no seal or sea lion captures anticipated to occur there is a **high likelihood** of **no impact** (Consequence Level 0).	0	Negligible
Turtles	With no captures of turtles anticipated to occur there is a **high likelihood** of **no impact** (Consequence	0	Negligible

	Level 0).		
Whales	With no captures of whales anticipated to occur there is a **high likelihood** of **no impact** (Consequence Level 0).	0	Negligible
Dolphins	With no captures of dolphins anticipated to occur there is a **high likelihood** of **no impact** (Consequence Level 0).	0	Negligible
Seabirds	With no captures of seabirds anticipated to occur there is a **high likelihood** of **no impact** (Consequence Level 0).	0	Negligible
ECOSYSTEM			
Habitat	The extremely small footprint of the anchors used for the drum lines and the high resilience of the sandy substrates where most are deployed results in a **high likelihood** (Likelihood Level 5) of only **negligible impacts** (Consequence Level 0).	0	Negligible
Community structure	The high historical level of commercial catch of sharks in this region was not found to have generated any measurable shift in the community structure for the broader fish community. Now that this catch has been reduced by half, an additional ~45 tonne of all species of sharks to be captured under the Proposal is **highly likely** (Likelihood 5) to have **no measurable effect** (Consequence Level 0) on the community structure of the West Coast Bioregion.	0	Negligible