

Mid West Aquaculture Development Zone Marine Fauna Interaction Management Plan



Prepared by
Department of Fisheries, Western Australia
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Executive Summary

The Marine Fauna Interaction Management Plan (MFIMP) is designed to achieve the Environmental Protection Authority's Objective for Marine Fauna: "To maintain the diversity, geographic distribution and viability of fauna at the species and population levels" and the proposal specific objective that *the MWADZ will have no adverse impact on the viability and persistence of the Abrolhos Islands populations of Australian sea lions or threatened sea birds*. More specifically the MFIMP provides a practical set of management and mitigation measures to address potential impacts to marine fauna. This MFIMP is based on a combination of best available data for marine fauna species found in the Houtman Abrolhos Islands and best practice aquaculture measures used in other jurisdictions.

While the MFIMP broadly addresses potential impacts for all marine fauna, an Adaptive Management Strategy (AMS), which focuses on the Endangered, Threatened and Protected species (ETPs) (including Australian sea lions (ASL)), has also been developed. The AMS provides a mechanism for management review in the event of an unacceptable level of adverse interactions with thresholds that trigger a management review (most conservatively set for ASLs and other marine mammals at one mortality or three entanglements). Sea cage design and farm maintenance are important for limiting negative interactions between marine fauna (including ASLs) and aquaculture infrastructure. Although the Department of Fisheries (Department) is not prescriptive in its approach to individual operator farm design, cages are likely to be similar to those already successfully employed in South Australia. The reason for this is threefold.

1. Such best practice designs allow operators to comply with the *Environmental Code of Practice For The Sustainable Development of Western Australia's Marine Finfish Aquaculture Industry* (thus demonstrating commitment to environmentally sustainable development).
2. It makes economic and social sense. Stock losses and damage to aquaculture gear are expensive and negative interactions with marine fauna (particularly ETPs) are damaging to the reputation of operators and the industry in general.
3. Its efficacy has been tested. Such practices are currently used in other jurisdictions with investigation into the potential impacts of marine finfish aquaculture determining the key measures to avoid negative interactions relating directly to cage design and maintenance and feed inputs (that is, farm maintenance) (DotE 2001).

To meet a) the EPA and b) the project-specific objective for marine fauna, operators will be required to implement the following measures –

- Predator exclusions mandatory on sea cages:

- operators are required to use durable (heavy duty) fish nets to exclude predators and avoid predation on farmed stock by sea lions, sharks and dolphins;
- sea lion jump fences of an appropriate height;
- appropriate bird exclusion mechanisms; for example, taut overhead bird netting to prevent access to stock and feed.
- Sea cage netting to be inspected regularly (weather permitting) to ensure its integrity is intact, free from debris and maintained to a standard that will minimise entanglement.
- Rigorous maintenance programs for all aquaculture infrastructure, particularly nets, ropes and cages, to be implemented to ensure there is limited capacity for entanglement of wildlife.
- Nets, ropes and cages maintained in proper working order; being taut, without fouling where possible and without holes that may cause entanglement of wildlife.
- All practicable measures taken to prevent marine mammals, turtles and seabirds from gaining access to or reward from the aquaculture operation:
 - feeding protocols to be observed to minimise the amount of uneaten feed entering the surrounding water;
 - to discourage predation by marine fauna, dead or moribund fish are to be removed regularly (weather permitting) and disposed of at silage, landfill or recycling plant.

Such an approach addresses the overwhelming evidence that the most suitable long term measures to reduce risk to ETPs involve:

- avoiding accidental and deliberate provisioning of wildlife through appropriate feed management arrangements including removal of any dead fish; and
- the risk to of wildlife entrapment and entanglement is minimised through the design of aquaculture gear (including sea cages) and operational management using best practice (Kemper *et al*, 2003).

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1. Introduction

1.1 Purpose

The Marine Fauna Interaction Management Plan (MFIMP) provides a practical approach to managing marine fauna interactions in the proposed Mid West Aquaculture Development Zone (MWADZ), situated in the Houtman Abrolhos Islands, (hereafter the Abrolhos Islands). Figure 1 provides a map of the Pelsaert and Easter groups of islands.

The MFIMP is an outcome-based plan that seeks to minimise potential impacts to marine mammals (particularly Australian sea lions), marine reptiles, seabirds and endangered, threatened and protected (ETP) finfish that occur in the Abrolhos Islands and the MWADZ. The MFIMP is an interim plan for the first five years of operation. If required the MFIMP will be amended to ensure its Objectives are being met.

Under the MFIMP, routine monitoring is restricted to ETP marine fauna, and divided into reportable and non-reportable monitoring. Sightings are non-reportable while interactions are a reportable occurrence defined as *any physical contact an individual (person), boat or gear has with a protected species that causes, or may cause death, injury or stress for the animal. This includes all catching (hooked, netted, entangled) and collisions as well as interactions that occur off the boats with an individual or individuals of these species.* This definition is consistent with the current Australian Fisheries Management Authority (AFMA) definition for protected species interactions under the *Environment Protection and Biodiversity Conservation Act 1997*:

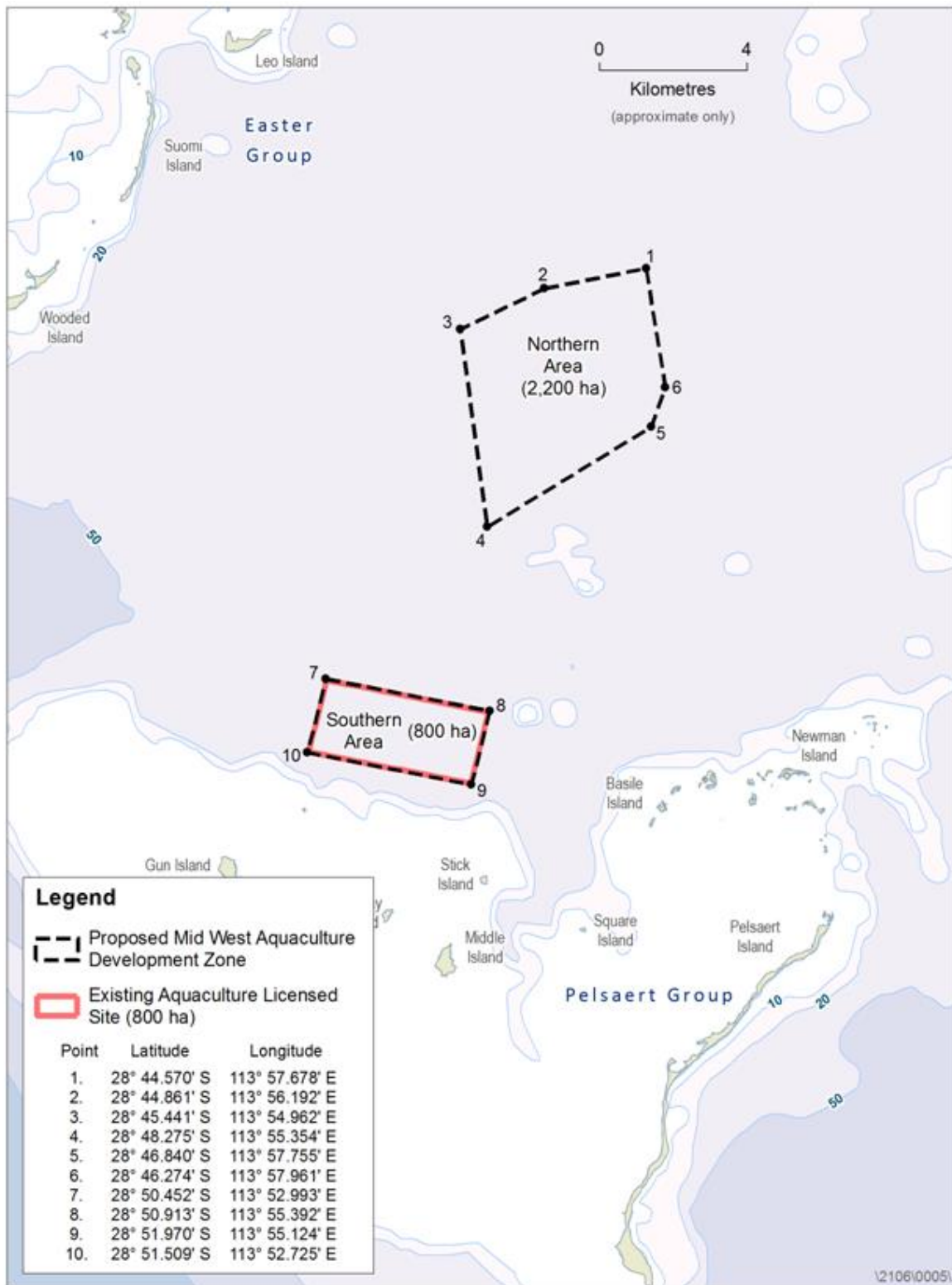
http://www.afma.gov.au/wp-content/uploads/2010/06/factsheets_introduction.pdf.

Key to this MFIMP is the inclusion of an Adaptive Management Strategy (AMS), with two AMS feedback loops, one for marine mammals (including ASLs) and one for avifauna and ETP finfish. This allows for the evolution of the management arrangements in the event marine fauna interactions are found to be unacceptably high based on an agreed set of thresholds (with ASL set most conservatively at one mortality, three entanglements, see Section 6).

1.2 Code of Practice

This MFIMP should be read in conjunction with the *Environmental Code of Practice For The sustainable Management of Western Australia's Marine Finfish Aquaculture Industry* (Code) (DoF/ACWA 2013), (**Appendix 1**). The Code outlines a series of voluntary best practice measures through a documented environmental management system (EMS) and recommends continual improvement through periodic review of operations. The Code allows operators to demonstrate they are operating within the principles of Ecologically Sustainable Development. Operators can demonstrate conformity with this Code by undertaking an Internal Audit (using

the ACWA Audit Checklist, which is available on the ACWA website: www.aquaculturecouncilwa.com) followed by a self-declaration by the Licensee.



1.3 Objective

The objective of this MFIMP is to ensure the MWADZ:

a) meets the EPA's Environmental Principles by adhering to best practice standards and demonstrating continuous improvement;

b) does not put at risk the EPA's objective for Marine Fauna "to maintain the diversity, geographic distribution and viability of fauna at the species and population levels"; and

c) meets the project specific objective that "the MWADZ will have no adverse impact on the viability and persistence of the Abrolhos Islands populations of Australian sea lions or threatened sea birds".

2. Existing Environment

The Abrolhos Islands are a group of islands located approximately 60 km west of Geraldton, Western Australia (WA). The islands are clustered into three main groups (from north to south: the Wallabi, Easter and Pelsaert groups) and extend over approximately 100 km from the northern to the southern ends. Both the MWADZ and the broader Abrolhos region have high conservation status owing to their near-pristine marine environmental qualities and the high socio-economic importance of the area. The following sections outline conservation significant marine fauna that have the potential to occur in the MWADZ and greater Abrolhos region.

2.1 Marine Mammals

In WA, marine mammals are protected under the *Wildlife Conservation Act 1950* (WC Act). Marine mammals are also protected by Commonwealth legislation under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and international conventions (CMS, CITES, IUCN) (BHP 2011).

The Abrolhos Islands and surrounding waters provide important habitats for an array of marine mammals, comprising mainly whales, dolphins and sea lions. Thirty one cetacean and two pinniped species are known to occur within a 50 km radius of the MWADZ (DoE 2015). Some species occasionally transit through the area at low densities, but there is insufficient information to confirm a definitive presence. Conservation significant marine mammal species deemed likely to occur within a 50 km radius of the MWADZ under the EPBC Act 1999 Protected Matters Search tool are the humpback whale, pygmy blue whale, Indo-Pacific bottlenose dolphin, common bottlenose dolphin and the Australia sea lion (**Table 1**).

The MFIMP is not entirely prescriptive, particularly in the area of cage design, meaning that there is the capacity to innovate for more appropriate solutions as they become available. However, operators will be required to demonstrate their operations do not result in adverse impacts to ETPs by implementing at the least the mitigation measures detailed in the MFIMP.

Table 1: Conservation status of marine mammals known or likely to occur in the MWADZ proposal area

Species	Conservation Status		Likelihood of occurrence within the MWADZ proposal area
	EPBC Act	WC Act	
Humpback whale (<i>Megaptera novaeangliae</i>)	Vulnerable, Cetacean Migratory	Not listed	Likely
Blue whale (<i>Balaenoptera musculus</i>)	Endangered, Migratory Cetacean	Schedule 2	Unlikely
Pygmy blue whale (<i>Balaenoptera musculus brevicauda</i>)	Endangered, Migratory Cetacean	Not listed	Likely
Bryde's whale (<i>Balaenoptera edeni</i>)	Migratory Cetacean	Not listed	Unlikely
Southern right whale (<i>Eubalaena australis</i>)	Endangered, Migratory Cetacean	Schedule 3	Unlikely
Killer whale (<i>Orcinus orca</i>)	Migratory Cetacean	Not listed	Unlikely
Indo-Pacific bottlenose dolphin (<i>Tursiops aduncus</i>)	Cetacean	Not listed	Likely
Bottlenose dolphin (<i>Tursiops truncatus</i>)	Cetacean	Not listed	Likely
Australian sea lion (<i>Neophoca cinerea</i>)	Vulnerable, Marine	Schedule 3	Likely
Dugong (<i>Dugong dugong</i>)	Marine, Migratory	Schedule 7	Unlikely
Spinner dolphin (<i>Stenella longirostris</i>)	Marine, Migratory	Not listed	Unlikely

2.2 Marine Reptiles

There are four marine turtle species (the loggerhead, flatback, leatherback and green turtles; **Table 2**) that may occur within a 50 km radius of the MWADZ. (DoE 2015). All marine turtles are currently protected under the WC Act and listed as vulnerable or endangered and, or, migratory under the EPBC Act.

Two sea snake species, namely the spectacled (*Disteira kingii*) and yellow-bellied sea snakes (*Pelamis platura*) are recorded as species that may occur or whose habitat may occur in the area (DoE 2015). These sea snake species are not resident

at the Abrolhos Islands, but during winter storms they may be transported south to the Abrolhos from Shark Bay (DoF 1998).

Table 2: Conservation status of marine turtle species known or likely to occur in the MWADZ proposal area

Species	Conservation Status		Likelihood of occurrence within the MWADZ proposal area
	EPBC Act	WC Act	
Green turtle (<i>Chelonia mydas</i>)	Vulnerable, Marine, Migratory	Schedule 3	Likely
Flatback turtle (<i>Natator depressus</i>)	Vulnerable, Marine, Migratory	Schedule 3	Unlikely
Loggerhead turtle (<i>Caretta caretta</i>)	Endangered, Marine, Migratory	Schedule 2	Unlikely
Leatherback turtle (<i>Dermochelys coriacea</i>)	Endangered, Marine, Migratory	Schedule 3	Unlikely

2.3 Seabird Overview

The Abrolhos Islands is the most significant seabird breeding location in the eastern Indian Ocean. Eighty per cent of the brown (common) noddies, 40 per cent of sooty terns and all lesser noddies found in Australia nest at the Houtman Abrolhos (Ross et al. 1995). It contains the largest breeding colonies in WA of wedge-tailed shearwaters, little shearwaters, white-faced storm petrels, white-bellied sea eagles, osprey, caspian terns, crested terns, roseate terns and fairy terns (Storr et al. 1986, Surman and Nicholson 2009). The Abrolhos also represents the northernmost breeding islands for both the Little Shearwater and White-faced Storm Petrel.

There are 26 seabird species (Table 3) that are known or likely to occur at the Abrolhos Islands and have the potential to be found within the MWADZ. Within the Pelsaert and Easter groups at the Abrolhos Islands, 17 of these 26 species have been confirmed as breeding regularly. These are the white-bellied sea eagle, osprey, wedge-tailed shearwater, little shearwater and white-faced storm petrel, Pacific gull, silver gull, Caspian tern, crested tern, bridled tern, roseate tern, fairy tern, brown noddy, lesser noddy, Eastern reef egret, pied oystercatcher, and pied cormorant (Halfmoon Biosciences 2015).

Seabirds are of great ecological significance in the Abrolhos region and have been considered carefully in this Plan. Management strategies for protecting seabirds and limiting their interaction with the proposed sea-cage operations are outlined below.

Table 3: The conservation status of marine avifauna species known or likely to occur in the MWADZ proposal area

Common name	Scientific name	EPBC Act status	Wildlife Conservation Act status	Presence in the vicinity of the MMADZ
Common noddy	<i>Anous stolidus</i>	Marine, Migratory	Schedule 5	Likely*
Lesser noddy	<i>Anous tenuirostris melanops</i>	Vulnerable, Marine, Migratory	Schedule 2	Likely*
Brown noddy	<i>Anous stolidus</i>	Marine, Migratory	not listed	Likely*
Bridled tern	<i>Onychoprion anaethetus</i>	Marine, Migratory	Schedule 5	Likely*
Sooty tern	<i>Onychoprion fuscata</i>	Marine	not listed	Likely*
Roseate tern	<i>Sterna dougallii</i>	Marine, Migratory	Schedule 5	Likely*
Fairy tern	<i>Sterna nereis nereis</i>	Vulnerable, Marine, Migratory	Schedule 3	Likely*
Crested tern	<i>Thalasseus bergii</i>	Marine	not listed	Likely*
Caspian tern	<i>Hydroprogne caspia</i>	Marine, Migratory	Schedule 5	Likely*
Eastern reef egret	<i>Egreta sacra</i>	Marine, Migratory	not listed	Likely*
Pied cormorant	<i>Phalacrocorax varius</i>	Not listed	not listed	Likely*
Pied oystercatcher	<i>Haematopus longirostris</i>	Not listed	not listed	Likely*
Pacific gull	<i>Larus pacificus</i>	Marine	not listed	Likely*
Silver gull	<i>Chroicocephalus novaehollandiae</i>	Marine	not listed	Likely*
South Polar skua	<i>Stercorarius maccormicki</i>	Marine, Migratory	Schedule 5	Likely*
Southern giant petrel	<i>Macronectes giganteus</i>	Endangered, Marine, Migratory	Schedule 5	Likely*
Black-browed albatross	<i>Thalassarche melanophris</i>	Marine, Migratory	Schedule 2 & 5	Likely*
Indian yellow-nosed albatross	<i>Thalassarche carteri</i>	Marine, Migratory	Schedule 2 & 5	Likely*
Wedge-tailed shearwater	<i>Ardenna pacifica</i>	Marine, Migratory	Schedule 5	Likely*
Fleshy-footed shearwater	<i>Ardenna carneipes</i>	Marine, Migratory	Schedule 5	Likely*
Hutton's shearwater	<i>Puffinus huttoni</i>	Marine, Migratory	Schedule 2	Likely*
Little shearwater	<i>Puffinus assimilis</i>	Marine	not listed	Likely*
Wilson's storm petrel	<i>Oceanites oceanicus</i>	Marine, Migratory	Schedule 5	Likely*
White-faced storm petrel	<i>Pelagodroma marina</i>	Marine	not listed	Likely*
White-bellied sea eagle	<i>Haliaeetus leucogaster</i>	Marine, Migratory	not listed	Likely*
Eastern osprey	<i>Pandion cristatus</i>	Marine, Migratory	Schedule 5	Likely*

Note: * indicates species breeds regularly within the Pelsaert and Easter Groups at the Arolhos Islands

2.4 Finfish (including sharks and rays)

The significant finfish (including sharks and rays) of the Abrolhos are considered in detail in DoF (2015a, 2015b). The benthic habitats of the Abrolhos support rich fish communities, with up to 389 fish species recorded (Hutchins 1997). The majority of these species (about 60 – 65%) are tropical species, some (about 15%) are subtropical and some (about 20–25%) are temperate species (Hutchins 1997, Watson *et al.* 2007). The structure of the fish assemblages differs between fished and non-fished areas (Watson *et al.* 2007) and there is a greater relative abundance of many of the targeted fish species in areas protected from fishing (Watson *et al.* 2007, Nardi *et al.* 2004).

A number of ETP finfish species occur at the Abrolhos Islands and have the potential to occur in the vicinity of the MWADZ. These comprise a variety of sharks, rays, Queensland grouper and syngnathids (pipefish, seahorses and sea-dragons). Most syngnathid species inhabit shallow, sheltered coastal waters, away from the proposed MWADZ. While Queensland grouper possibly exist at the Abrolhos Islands the likelihood of an interaction with the proposed sea-cage operations was considered remote (DoF 2015b). However, interactions between species of sharks and rays and the proposed sea cages are considered more plausible (DoF 2015b). Sharks and rays that may potentially occur at Abrolhos Islands within the vicinity of the MWADZ and have conservation status under Commonwealth (EPBC Act) and, or, WA legislation (*Fish Resources Management Act 1994*) are listed in **Table 4**.

The species considered most likely be present in the vicinity of the MWADZ, be attracted to marine finfish aquaculture and be of a physical size capable of interacting with the sea cages are the white shark (*Carcharodon carcharias*) and tiger shark (*Galeocerdo cuvier*).

Due to their morphology, it is considered unlikely that rays would become entangled in sea cage mesh or nets or captured within the cages.

Table 4: The conservation status of shark and ray species possibly occurring at the Abrolhos Islands and within the vicinity of the MWADZ

Common Name	Scientific Name	Conservation Status		Presence in the Vicinity of the Mid West Aquaculture Development Zone
		Commonwealth (EPBC Act) Status	Western Australian Status	
Grey Nurse Shark	<i>Carcharias taurus</i>	Vulnerable	Schedule 3 (WC Act)	Possible
Whale Shark	<i>Rhincodon typus</i>	Vulnerable, Migratory	Totally protected fish (FRMA) Schedule 7 (WC Act)	Possible
White Shark	<i>Carcharodon carcharias</i>	Vulnerable, Migratory	Totally protected fish (FRMA) Schedule 3 (WC Act)	Likely
Shortfin Mako Shark	<i>Isurus oxyrinchus</i>	Migratory	Not listed	Unlikely
Longfin Mako Shark	<i>Isurus paucus</i>	Migratory	Not listed	Unlikely
Scalloped Hammerhead	<i>Sphyrna lewini</i>	Migratory	Not listed	Possible
Smooth Hammerhead	<i>Sphyrna zygaena</i>	Migratory	Not listed	Possible
Green Sawfish	<i>Prisitis zijsron</i>	Vulnerable	Totally protected fish (FRMA) Schedule 3 (WC Act)	Not likely
Giant Manta Ray	<i>Manta birostris</i>	Migratory	Not listed	Possible
Tiger shark ¹	<i>Galeocerdo cuvier</i>	Not listed	Not listed	Likely

¹ Tiger shark is not considered to be an ETP species, however, as an iconic marine species is considered to be representative of many of the ETP species of fish listed above.

3. Potential Impacts

The potential for adverse interactions between marine fauna and the proposed MWADZ was reviewed in the Environmental Impact Assessment (BMT Oceanica 2015). A number of risk factors were identified (Section 3) including the physical presence of the aquaculture gear, vessel movements, artificial light, noise and vibration and fish farming activities. Mitigation and management measures will be applied in order to minimise the identified risk factors (Section 5).

The following section provides an overview of the potential environmental stressors that may have an impact on marine fauna within the MWADZ. The information is based on a literature review of the best available scientific data, as well as documented information on the adverse interactions of marine fauna with marine aquaculture. The environmental stressors that were identified to potentially have an impact on marine fauna are:

- physical presence of aquaculture gear;
- vessel movements;
- artificial light;
- noise and vibration; and
- fish farming activities (e.g. feeding).

A detailed assessment of the potential impacts to marine fauna is provided in sections 9 and 10 of the Public Environmental Review/Environmental Impact Statement (PER/EIS) (DoF 2016).

3.1 Physical Presence of Aquaculture Gear

The physical presence of aquaculture farms has the potential to create barriers to fauna movement if it restricts migratory or transit routes of marine mammals, marine reptiles and seabirds. The presence of aquaculture gear could also attract larger marine predators including sharks, sea lions and dolphins due to the aquaculture gear acting as a Fish Aggregation Device (FAD). Sea-based aquaculture gear and equipment known to potentially impact marine fauna include:

- sea cages;
- mooring and anchoring systems;
- feeding barges; and
- vessels (service and accommodation).

Potential impacts to marine fauna related to the physical presence of aquaculture gear during the installation process and operational activities include:

- changes in natural feeding behaviour of marine fauna as a result of higher fish density from FAD effects;

- serious injury or mortality of marine fauna due to entanglement or entrapment in anti-predator nets;
- habitat changes due to placement of aquaculture gear and degradation of marine water and sediment quality; and
- changes to marine fauna distribution and migration patterns due to avoidance or attraction cues.

3.2 Vessel Movements

Vessels will operate throughout the MWADZ during the installation of the aquaculture gear and for ongoing operational activities. A range of vessel types, including service vessels, supply vessels and feeding barges, may be active within the area. The potential impacts to marine fauna related to the physical presence of vessels during the installation process and operational activities include:

- injury or death of mobile marine fauna from vessel strikes;
- disturbance to marine fauna behaviour from vessel movements; and
- habitat degradation (e.g. through anchoring and moorings).

3.3 Artificial Light

Artificial light spill and glow generated during the installation and operation of aquaculture farms within the MWADZ may have potential impacts on marine fauna. Sources of light emissions from activities within the area that may affect marine fauna include:

- routine lighting on aquaculture gear;
- navigation marker lighting; and
- vessel lighting.

Light spill can have the following potential impacts to marine fauna:

- attraction and disorientation of marine turtle hatchlings;
- injury or death of juvenile seabirds attracted to lighting and flying into aquaculture gear; and
- modification of fauna foraging behaviour around aquaculture gear due to light spill on the water.

3.4 Noise and Vibration

Noise and vibrations generated during the installation of aquaculture gear and during operational activities within the MWADZ may have potential impacts on marine fauna. The primary sources of potential noise and vibration generation include:

- vessel movements in the area;
- machinery used to install the sea cages, moorings and anchoring systems; and

- machinery used in operations (e.g. hand-held welders, mobile cranes, hand tools, small power tools, blowers and winches) (NSW Department of Primary Industries 2012).

Anthropogenic marine noise has the potential to impact marine fauna that rely on acoustic cues for feeding, communications, orientation and navigation. The extent of impacts depends on a number of variables, including the frequency range and intensity of the emitting noise, the receiving environment (e.g. salinity, water depth, and sea bed type), metocean conditions, characteristics and sensitivity of the animal and its distance from the source. Marine fauna considered sensitive to underwater noise and vibration include cetaceans, marine turtles, seabirds and fish.

Underwater noise and vibration can have the following impacts on marine fauna:

- behavioural changes;
- temporary or permanent injury and (in extreme cases) mortality;
- stress response;
- complete avoidance of the immediate area (habitat displacement);
- attraction to the noise source; and
- disruption to underwater acoustic cues for navigation, foraging and communication.

The assessment provided in the PER/EIS (DoF 2016) concluded that noise and vibration from construction and operational activities within the MWADZ did not pose a significant risk to marine fauna in the area. The majority of noise and vibration is likely to be generated by machinery potentially used to anchor aquaculture gear to the seabed. This is an installation activity and as such is neither sustained nor ongoing.

Ongoing noise and vibrations are also likely to be generated by vessel movements within the aquaculture zone (NSW DPI 2012). Therefore, the MFIMP provides management and mitigation measures designed to reduce the impact of noise generated by activities in the MWADZ.

3.5 Fish Farming Activities

Fish farming activities within the MWADZ have the potential to have adverse impacts on marine fauna in the area. The presence of cultured stock, dead or moribund stock, harvesting activities and the provision of feed into the sea cages, may attract or deter marine fauna to or from the area. An increase in food availability within the area has the potential to cause an:

- increase in visitation rates of marine fauna species (e.g. Australian sea lions);
- increase in the duration of visits of marine fauna species (e.g. sharks);
- alteration in the natural feeding behaviour/regimes of marine fauna species; and
- increase in the abundance of opportunistic marine fauna (e.g. silver gulls).

4. Mitigation and Management Measures

The mitigation strategies contained within the MFIMP are commensurate with the perceived level of risk and deliberately non-prescriptive. They do not require proponents to employ certain sea cage types, or particular marine fauna exclusion devices. However, they do require best practice approach whereby proponents will be required to maintain the integrity of their aquaculture gear and keep thorough records of marine fauna interactions (further details regarding monitoring requirements are provided in Section 6 & 7).

4.1 Physical Presence of Aquaculture Gear

Although the Department is not overly prescriptive in its approach to individual operator farm design, cages are likely to be similar to those already successfully employed in South Australia. The reason for this is threefold:

1. Such best practice designs allow operators to comply with the *Environmental Code of Practice For The Sustainable Development of Western Australia's Marine Finfish Aquaculture Industry* (thus demonstrating commitment to environmentally sustainable development).
2. It makes economic and social sense. Stock loss and aquaculture gear damage are expensive and negative interactions with marine fauna (particularly ETPs) is damaging to the reputation of operators and the industry in general.
3. Its efficacy has been tested. Such practices are currently used in other jurisdictions with investigation into the potential impacts of marine finfish aquaculture determining the key measures to avoid negative interactions relating directly to cage design and maintenance and feed inputs (i.e. farm maintenance) (DotE 2001).

To meet a) the EPA objective for marine fauna 'to maintain the diversity, geographic distribution and viability of fauna at the species and population levels; and b) the proposal specific objective that the MWADZ will have no adverse impact on the viability and persistence of the Abrolhos Islands populations of Australian sea lions or threatened sea birds, operators will be required to implement the following measures:

- Predator exclusions mandatory on sea cages:
 - Operators are required to use durable fish nets (heavy duty) to exclude predators and to avoid predation on farmed stock by sea lions, sharks and dolphins.
 - Sea lion jump fences of an appropriate height;
 - Appropriate bird exclusion mechanisms for example taut overhead bird netting to prevent access to stock and feed;
- Sea cage netting to be inspected regularly (weather permitting) to ensure its integrity is intact, free from debris and maintained to a standard that will minimise entanglement;

- Rigorous maintenance programs for all aquaculture infrastructure, particularly nets, ropes and cages, to be implemented to ensure there is limited capacity for entanglement of wildlife;
- Nets, ropes and cages maintained in proper working order; being taught, without fouling where possible, and without holes that may cause entanglement of wildlife;
- All practicable measures taken to prevent marine mammals, turtles and seabirds from gaining access to or reward from the aquaculture operation;
 - Feeding protocols to be observed to minimise the amount of uneaten feed entering the surrounding water;
 - To discourage or predation by marine fauna, dead or moribund fish are to be removed regularly (weather permitting) and disposed of at silage, landfill or recycling plant location

4.2 Vessel Movements

To minimise potential interactions or vessel strikes with marine fauna, all staff operating on-board vessels in the MWADZ are required to:

- abide by the Australian National Guidelines for Whale and Dolphin Watching (i.e. not permitted to approach within 100 metres of a whale and within 50 metres for dolphins and turtles - refer to **Figure 2**);
- implement observer protocols (i.e. routinely keep a watch for marine fauna (notably marine mammals and turtles) when travelling between sea cages and the accommodation barge); and
- restrict construction and operational activities to daylight hours (emergency situations excepted).

Upon observing marine fauna, it is recommended that skippers operating vessels in the MWADZ:

- avoid making sudden or repeated changes in direction, or generating excessive noise, near marine fauna in the area;
- operate vessels within the proposed MWADZ at reduced speed limits (i.e. less than 8 knots); and
- avoid the use of vessels at night wherever practicable.

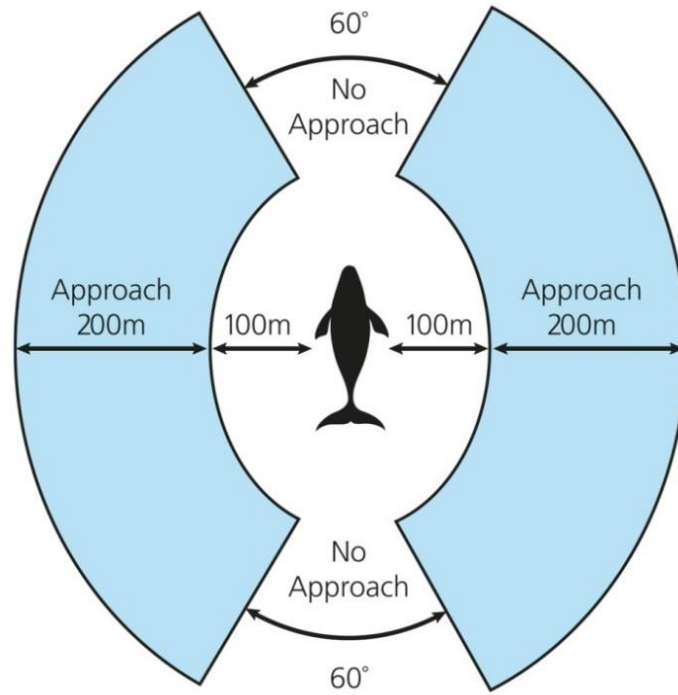


Figure 2: Approach Distances for Marine Fauna (whales = 100 metres, dolphins and turtles = 50 metres)

4.3 Artificial Light

The recommended mitigation strategies for the management of artificial light are as follows:

- minimise light intensity on vessels to as low as reasonably practicable when conducting activities at night;
- avoid the use of bright white lights (e.g. mercury vapour, metal halide, halogen and fluorescent light) on aquaculture gear (orange lights, red lights and low-pressure sodium lights are to be used where practicable);
- reduce light spill by shielding lights, pointing lights directly at the work area (directional alignment), reducing the amount of light shining directly onto water and covering windows with tinting or drapes to reduce light emissions from service vessels;
- reduce horizon glow through the use of downward-facing luminaries, attention to reflecting surfaces (adjusting lights so they don't shine onto reflective surfaces) and reducing the intensity of indoor lighting used in accommodation and feed barges, without compromising worker safety; and
- restrict lighting on moored vessels at night to the minimum required for safe operations.

4.4 Noise and Vibration

Noise and vibration emissions generated from the aquaculture activities within the MWADZ will be managed through measures including:

- routinely maintaining and inspecting noise generating equipment (e.g. vessel engines, drilling equipment) to reduce unnecessary noise from the equipment;
- fitting of sound suppression devices (e.g. mufflers) on noise-emitting equipment (if applicable);
- vessel activity should be limited to essential business activities at all times to avoid excessive noise and vibration; and
- preferred routes to various utility points must be documented and adhered to

4.5 Fish Farming Activities

4.5.1 Feeding Practices

The recommended mitigation strategies for managing feeding activities are as follows:

- development and application of feeding protocols to minimise the amount of uneaten feed entering the surrounding water;
- proponents shall wherever practicable aim to minimise feed wastage to less than 2% through use of high quality and sinking pelletised feeds;

- all pelletised feeds used in open sea cages must be Department of Agriculture and Water Resources (formerly AQIS) approved or produced by a manufacturer that complies with AS/NZS ISO 9001:2008 standards (or equivalent); contemporary feeding technologies and practices will be used in order to minimise feed wastage to the surrounding environment;
- pellet food will primarily be stored on site in bulk feed hoppers and any loose bags of feed will be stored in either the below-deck compartment of the supply boat or on-deck covered by heavy duty PVC tarpaulin or similar;
- staff will be adequately trained in the use of the portable blower system used to deliver feed into the sea cages to ensure minimal or no spillage and no distribution of feed outside the sea cages; and
- aquaculture staff and visitors will be prevented from feeding, touching or swimming with marine fauna within the MWADZ.

4.5.2 Farm Fish Mortalities

The recommended mitigation strategies for the management of fish farm mortalities are as follows:

- dead and moribund stock will be removed from the sea cages at least weekly, or more frequently in the event of sustained or chronic mortalities, and disposed of appropriately;
- all dead fish removed will be stored in enclosed containers until disposed of appropriately.

5 Monitoring and Incident Reporting

5.1 Monitoring

Routine Monitoring will be focused on Australian sea lions, other marine mammals, ETP finfish (sharks and rays), protected turtles and avifauna (listed under the WC Act). For the first two years operators will be required to keep marine fauna logs. At this time, the routine monitoring requirement may be reviewed based on those logs. Farm staff will be required to record interactions with wildlife, such as aggression, access of wildlife to sea cages, mortality, collision, long-term roosting, entrapment, or entanglement of wildlife in the aquaculture gear. Logs should also report:

- the type and frequency of interaction;
- location and likely cause of the interaction; and
- species involved.

Where multiple fish farms are operating, data will be consolidated and shared in a common database. Results of the individual monitoring programs will be reported annually in the Annual Compliance Report submitted by the operators.

Interactions (as defined in the AMS below) must be reported and addressed initially in the following manner:

5.2 Incident Reporting and Immediate Response Requirements

5.2.1 *Marine Mammals, Turtles and Other Marine Reptiles*

- All collision or entanglement incidents will be reported to the DPaW Wildcare Hotline on +61 (0) 89474 9055 and the Geraldton DPaW office within 24 hours of the incident occurring and the details of the incident, including the actions taken, documented;
- Any reportable incident (7.1.3 or 7.1.4) shown in the AMS loop will require an appropriate management response determined in consultation with DPaW, the OEPA and DoF, to the satisfaction of the CEO of the OEPA;
- If marine fauna is discovered distressed due to entanglement or entrapment in aquaculture gear, then reasonable efforts will be made by staff to free the animal if safe to do so; and
- A list of emergency contact numbers will be displayed on-board service vessels and work platforms used to service the farms.

5.3.2 *Marine Avifauna*

- Upon discovery of a distressed seabird (entangled or entrapped) in aquaculture gear, efforts will be made by staff to release the bird. Entanglements or entrapments of seabirds in aquaculture gear will be reported to DPaW on +61 (0) 89474 9055 within 24 hours.
- In the event of a collision between a seabird and aquaculture gear, the following procedures will be followed:
 - Pick up the bird with a towel, keeping it lightly wrapped and the wings contained (folded in natural position against side of bird's body). Be aware of the sharp bill. Wear gloves and eye protection.
 - Place the bird in a well-ventilated cardboard box and place the box in a covered, quiet location.
 - Record and report the species, number, location found, likely cause of collision and any injuries.
 - Do not forcefully administer food or water via the bird's mouth.
 - If the bird has no obvious signs of injury, the bird may be released. The recommended approach is to take the bird to a quiet area at dawn and release the bird in an area free from obstructions (masts, railings, wires, etc.) so that it may take off directly into the wind.

5.3.3 *Sharks and Rays*

- If a shark enters the sea cages, makes contact with, or becomes entangled in any aquaculture gear, operators should notify the regional Department office +61 (0) 89920 8400 as soon as reasonably practicable. If the shark is an ETP

species operators should also advise DPaW through the Wildcare Hotline +61 (0) 89474 9055.

- The Department will advise on a case by case basis how best to respond, noting that human safety is a first order priority. DoF will also, where necessary, assist with relevant approvals to allow the appropriate actions to be undertaken;
- Upon establishing contact with the Department (and DPaW as appropriate), all reasonable efforts will be made by fish farm staff to release or disentangle the shark alive.

6 Adaptive Management Strategy

The MFIMP comprises two separate AMS feedback loops to account for the different species groups; consequently, the feedback loops differ in terms of triggers or thresholds (Figures 3 & 4). The most rigorous of the feedback loops is for marine mammals with trigger thresholds of one mortality or three entanglements.

An interaction means *any physical contact an individual (person), boat or gear has with a protected species that causes, or may cause death, injury or stress for the animal. This includes all catching (hooked, netted, entangled) and collisions as well as interactions that occur off the boats with an individual or individuals of these species.* The categories of interaction are further defined below.

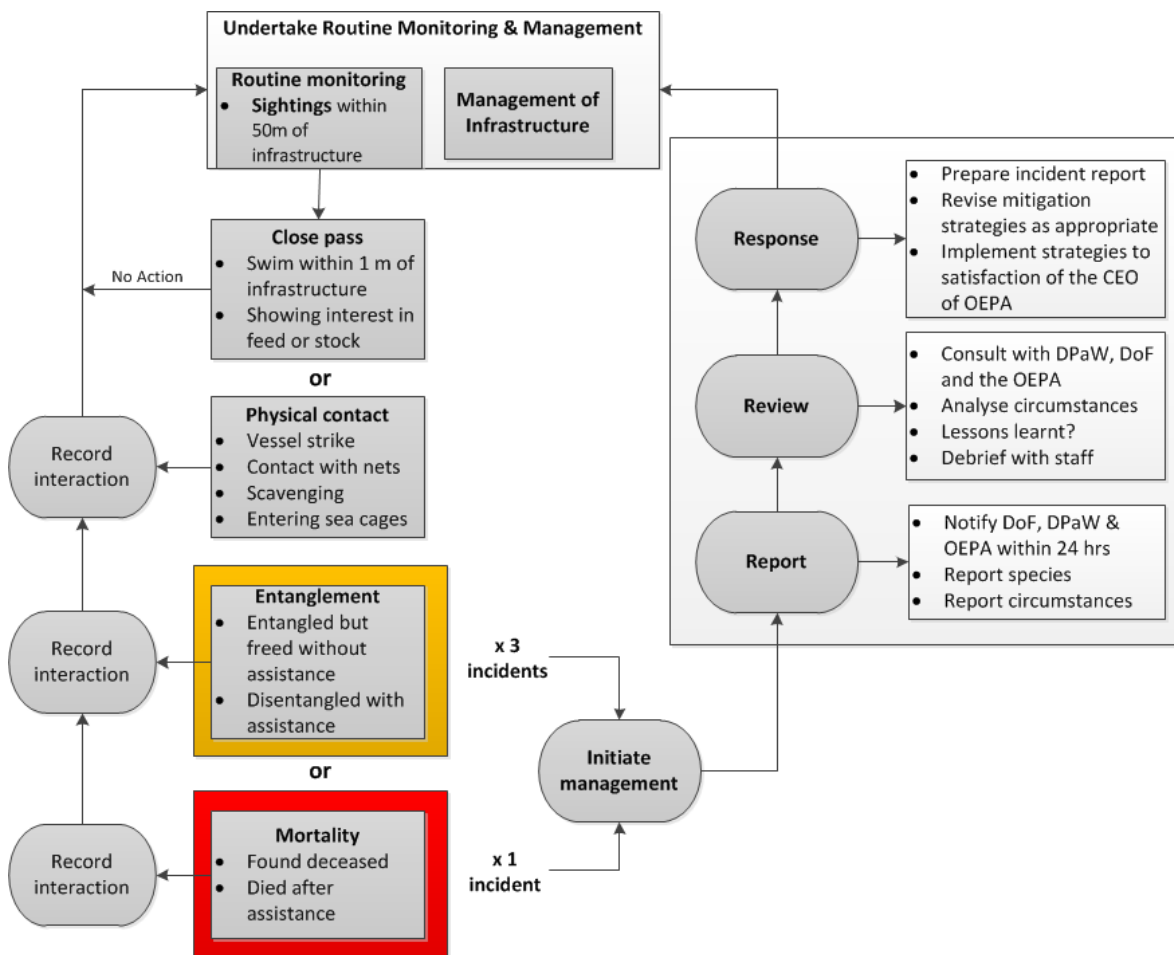


Figure 3: Marine Mammals

Restricted to marine mammals including ASLs (listed under WC Act); Management intervention after 3 entanglements or 1 mortality.

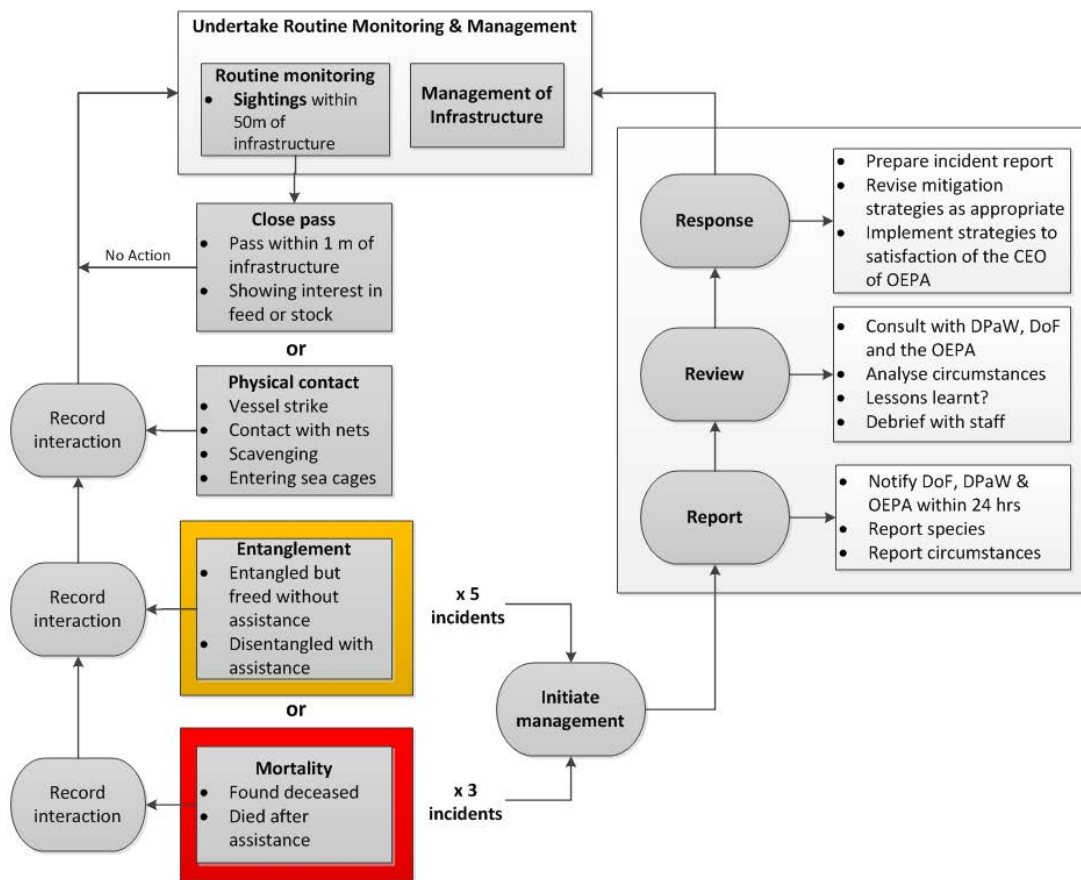


Figure 4: Marine Avifauna and Finfish
 Restricted to ETP avifauna and finfish (listed under WC Act); Management intervention after 5 entanglements or 3 mortalities.

Figure 3 & 4 Adaptive Management Strategy

The AMS also contains a reportable/non-reportable caveat. Reportable interactions must be reported within 24 hours as defined below. Non-reportable interactions are recorded and included in the Annual Compliance Report.

6.1 Interactions categories

6.1.1 Sighting

Under the AMS sightings refer only to ETPs noted within 50 metres of aquaculture gear. In particular, the purpose of recording sightings is to demonstrate the presence or absence of ETPs within the vicinity of the MWADZ over the initial period of operation (most notably to determine the behaviour of ASLs). This will inform management arrangements into the future and be reviewed after a period of two years. Sightings, which are non-reportable under the AMS, will be documented and provided to the Department as a component of the Annual Compliance Report.

6.1.2 Close pass

Close passes are when an animal comes within one metre of the aquaculture gear without making contact. This includes fauna that show an interest in the aquaculture gear, the stock contained within it, or the opportunity to consume waste feeds. Close passes are recordable but not reportable under the AMS. Where no physical contact is recorded, close passes will be documented and provided to the Department as a component of the Annual Compliance Report.

6.1.3 Physical contact

Physical contact occurs when an animal come into contact with aquaculture gear either inadvertently (as in a vessel strike) or deliberately while attempting to prey upon aquaculture stock. Physical contact would typically be short-lived, but could be repeated (such as repeated attempts to break into a sea cage). Physical contact does not include instances where the animal becomes entangled, but does include breaches of the aquaculture gear including where an animal becomes trapped in a sea cage. Physical contact is non-reportable, with the exception of vessel strike which should be reported to relevant authorities whether or not a mortality results.

6.1.4 Entanglement

Entanglement results when an animal initially makes physical contact, then subsequently becomes entangled in the netting, lines or other components of the aquaculture gear. Entanglements are differentiated from physical contact by the duration: a contacts greater than 30 seconds constitutes an entanglement. Management response is required after three entanglement incidents.

6.1.5 Mortality

Mortality refers to the death of an animal as a direct result of aquaculture operations, either by vessel strike, stress or prolonged entanglement. This may include the death of an animal trapped within the aquaculture gear, the death of animal while entangled, or the death of an animal that was freed from entanglement, but subsequently died. Management response is required after one mortality incident.

6.2 Management responses

6.2.1 Report

Upon a reportable incident (7.1.4 or 7.1.5), operators are required to notify the Department, DPaW and the OEPA within 24 hours. Operators should provide as many details as possible about the incident, including:

- Species;
- Size and gender (where possible to determine);
- Behaviour prior to the incident; and

- Present demeanour (i.e. agitated, lethargic).

6.2.2 Review

The review component of the AMS requires proponents to investigate the circumstances behind a reportable incident. Managers should interview and debrief all staff, including discussion on prevention of future incidents. The results of the review should be submitted to the Department, DPaW and the OEPA within seven days of the reportable incident occurring. The outcomes of this investigation must be of a standard that will assist the preparation of an incident report for the Response component of the AMS.

6.2.3 Response

On completion of an incident report, the Department, DPaW and the OEPA will consider the circumstances surrounding the reportable incident. Depending on the outcomes of the review, proponents may be required to implement strategies to prevent similar occurrences in the future. The revision of mitigation and management strategies is on an as-appropriate basis and the outcome must be to the satisfaction of the CEO of the OEPA. Examples of response mechanisms are re-tensioning netting; increasing seal jump fence height or reviewing feed or maintenance regimes.

7 Implementation

7.1 Reporting and auditing

Proponents will submit an Annual Compliance Report summarising the outcomes of the MFIMP to the OEPA and the Department by 1 June annually in accordance with the conditions of their approval.

Annual Compliance Reports should include as a minimum:

- An executive summary summarising the results of the program;
- A description of the results, including the appropriate use of Tables and Figures;
- The number of interactions recorded in the reporting period, including physical contacts, entanglements and mortalities (if any); and
- Appropriate appendices, providing raw data and results of any reviews or responses, including the performance of new mitigation methods.

7.2 Review and revision

The Plan is an interim plan designed to monitor and manage marine fauna interactions in the first five years of operation. The Plan will be reviewed and revised at the end of the five year period, or when production reaches 7 200 tonnes per annum, whichever occurs first. The intent of the review is to ensure the program is commensurate with the level of risk.

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