Mid West Aquaculture Development Zone

Marine Fauna Interaction Management Plan

Prepared by

Department of Fisheries, Western Australia

Version 3.0 – April 2016

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1. Introduction

1.1 Purpose

This Marine Fauna Interaction Management Plan (MFIMP) focuses primarily on managing potential impacts to marine mammals, marine reptiles and marine avifauna associated with the Mid West Aquaculture Development Zone (MWADZ) at the Abrolhos Islands. Specifically, this MFIMP:

- provides an overview of the potential impacts that may occur to marine fauna during the installation process and operational activities;
- outlines management measures and actions adopted to mitigate potential impacts to marine fauna during the sea cage installation process and during operational activities;
- outlines the monitoring requirements/programs required to be serviced by operators within the MWADZ; and
- outlines the marine fauna incident reporting and response strategies required of operators within the MWADZ.

Specific information relating to the management of interactions with other marine fauna, including finfish, are covered in more detail in the MWADZ Environmental Monitoring and Management Plan (EMMP) and the Public Environmental Review (PER/EIS) document. This MFIMP is an appendix to the PER document used for strategic assessment of the MWADZ proposal.

1.2 Objectives

The primary aim of this MFIMP is to ensure that activities conducted within the proposed MWADZ do not cause any significant disturbance to marine fauna within the Abrolhos Islands Fish Habitat Protection Area (FHPA).

The objectives of this plan include minimising:

- human interactions with marine fauna;
- any potential injuries or fatalities to marine fauna that may result from collision with vessels or entanglement;
- noise and vibration disturbance to marine fauna;
- potential impacts to marine fauna from artificial light;
- potential impacts posed to marine fauna by aquaculture infrastructure; and
- adverse effects of fish farming activities within the proposed MWADZ on marine fauna.

1.3 Structure

The MFIMP provides the following information:

- an overview of fauna species likely to occur within the MWADZ;
- identification of potential impacts of the MWADZ on marine fauna species;
- identification of management measures to minimise the impacts associated with the installation of aquaculture infrastructure and during operational activities;
- an overview of environmental project management strategies; and
- information on the environmental monitoring, recording and reporting requirements for proponents operating within the MWADZ.

1.4 Project Overview

The Department of Fisheries, on behalf of the Minister for Fisheries, proposed to create an 'Aquaculture Development Zone' to provide a management precinct for prospective aquaculture proposals within State Waters, approximately 65 kilometres west of Geraldton within the FHPA of the Abrolhos Islands. The strategic proposal area was selected to maximise suitability for marine finfish aquaculture and minimise potential impacts on existing marine communities and disruption to existing human uses.

The strategic proposal, also known as the MWADZ, encompasses 3,000 hectares (ha) of marine waters within two separate areas: the northern area (approx. 2,220 ha) and the southern area (approx. 800 ha) (Refer to Figure 1).

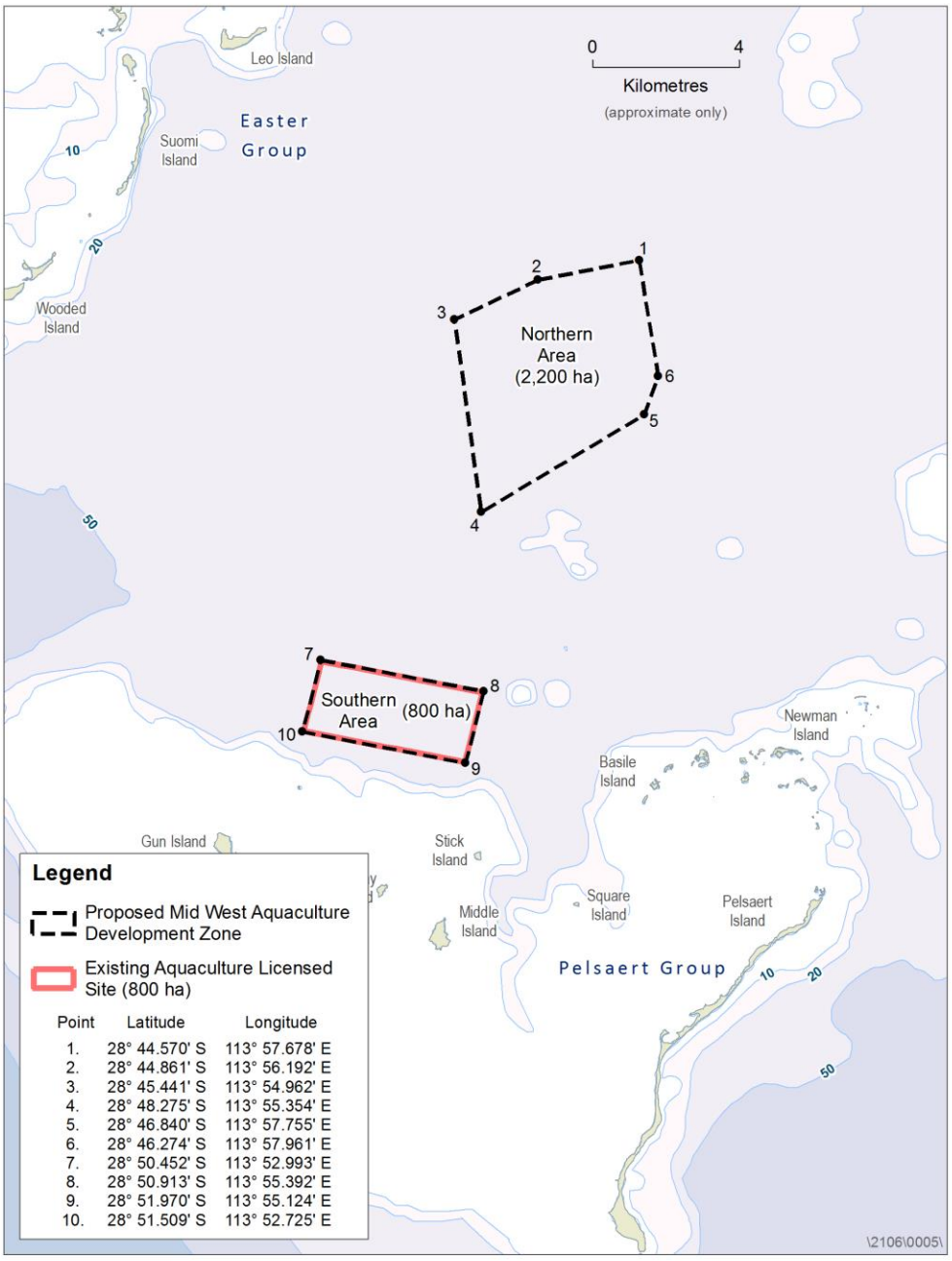
The MWADZ is established through a process that primarily involves environmental assessment of the zone as a strategic proposal under Part IV of the *Environmental Protection Act 1986*. Approval of this strategic proposal will create opportunities for existing and future aquaculture operators to refer their proposals to the Environmental Protection Authority as 'derived proposals'. The objective is a more streamlined assessment and regulation process due to early consideration of potential environmental impacts and cumulative impacts identified during the assessment process for the zone.

Operators within the MWADZ are likely to use circular surface sea cages for the purposes of finfish aquaculture. Multiple sea cages (typically up to 14 in number) are setup within a grid (referred to as a cage cluster) that is securely anchored to the sea bed. A cage cluster of 14 sea cages, anchoring system included, occupies approximately 130 hectares and must be entirely contained within an aquaculture lease.

The key components of the marine finfish aquaculture infrastructure likely to be used in the MWADZ include the following:

- sea cages
- feeding barges
- anchoring/mooring systems
- operational, supply and accommodation vessels

Figure 1: Location of the Mid West Aquaculture Development Zone



2. Existing Environment

2.1 Marine Mammals Overview

There are 31 species of cetaceans and two pinniped species which have the potential to occur within the vicinity (i.e. less than 50 km) of the MWADZ area (DoE 2014 a). Some of these species occasionally transit through the area at low densities (e.g. sperm whales, Antarctic minke whales, oceanic dolphins) although the information currently available is insufficient to confirm a definitive presence within the MWADZ area (BMT Oceanica 2015). Other dolphin species (including common dolphin, Risso's dolphin and spotted dolphin) have not previously been observed in the mid-west region of WA (Oceanica 2010). Given that these species are unlikely to venture into the MWADZ area they are not considered further in this MFIMP.

Nevertheless, the management actions proposed in this plan will be effective for all marine mammal species.

The marine mammal species considered in this MFIMP are:

- Humpback whale (*Megaptera novaeangliae*)
- Blue whale (*Balaenoptera musculus*)
- Pygmy blue whale (*Balaenoptera musculus brevicauda*)
- Southern right whale (*Eubalaena australis*)
- Bryde's whale (*Baelenoptera edeni*)
- Killer whale (*Orcinus orca*)
- Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)
- Bottlenose dolphin (*Tursiops truncatus*)
- Spinner dolphin (*Stenella longirostris*)
- Australian sea lion (*Neophoca cinerea*)
- Dugong (*Dugong dugon*)

In Western Australia, 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 conservation status of the eleven marine mammal species listed above is provided in Table 1.

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 (*Megaptera novaeangliae*)	Vulnerable, Cetacean Migratory	Schedule 1[1]	Likely
Blue whale (*Balaenoptera musculus*)	Endangered, Migratory Cetacean	Schedule 1	Unlikely
Pygmy blue whale (*Balaenoptera musculus brevicauda*)	Endangered, Migratory Cetacean	Schedule 1	Likely
Bryde's whale (*Balaenoptera edeni*)	Migratory Cetacean	Not listed	Unlikely
Southern right whale (*Eubalaena australis*)	Endangered, Migratory Cetacean	Schedule 1	Unlikely
Killer whale (*Oricinus orca*)	Migratory Cetacean	Not listed	Unlikely
Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)	Cetacean	Not listed	Likely
Bottlenose dolphin (*Tursiops truncatus*)	Cetacean	Not listed	Likely
Australian sea lion (*Neophoca cinerea*)	Vulnerable, Marine	Schedule 4	Likely
Dugong (*Dugong dugong*)	Marine, Migratory	Schedule 4	Unlikely
Spinner dolphin (Stenella longirostris)	Marine, Migratory	Not listed	Unlikely

2.2 Marine Reptile Overview

There are four marine turtle species (Table 2) that are known or likely to occur within the MWADZ area. All marine turtles are currently protected under the *Wildlife Conservation Act 1950* (WA) and listed as vulnerable or endangered and/or, migratory under the EPBC Act.

Two sea snake species, namely the spectacled sea snake (*Disteira kingii*) and yellow-bellied sea snake (*Pelamis platura*) are recorded by the EPBC Protected Matters database 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 and further north (Department of Fisheries 1998).

[1] Designates fauna under the *Wildlife Protection Act 1950* that is rare or likely to become extinct and is in need of special protection.

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 (*Chelonia mydas*)	Vulnerable, Marine, Migratory	Schedule 1[2]	Likely
Flatback turtle (*Natator depressus*)	Vulnerable, Marine, Migratory	Schedule 1	Unlikely
Loggerhead turtle (*Caretta caretta*)	Endangered, Marine, Migratory	Schedule 1	Unlikely
Leatherback turtle (*Dermochelys coriacea*)	Endangered, Marine, Migratory	Schedule 1	Unlikely

2.3 Marine Avifauna Overview

There are 26 marine avifauna species (Table 3) that are known or likely to occur within the MWADZ area. Within the Pelsaert and Easter Groups at the Abrolhos Islands, 17 of these 26 species have been confirmed to breed 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).

Of the seabird species known to occur in the vicinity of the MWADZ area, five species are currently listed under the *Western Australian Wildlife Conservation (Specially Protected Fauna) Notice 2014* as Schedule 1 species: (i.e. fauna that is rare or likely to become extinct) and nine species are listed as Schedule 3 species: (i.e. migratory birds protected under an international agreement such as the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) (See Table 3).

[2] Ibid

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	*Anous stolidus*	Marine, Migratory	Schedule 3	Likely
Lesser noddy	*Anous tenuirostris melanops*	Vulnerable, Marine, Migratory	Schedule 1	Likely*
Brown noddy	*Anous stolidus*	Marine, Migratory	not listed	Likely*
Bridled tern	*Onychoprion anaethetus*	Marine, Migratory	Schedule 3	Likely*
Sooty tern	*Onychoprion fuscata*	Marine	not listed	Likely
Roseate tern	*Sterna dougallii*	Marine, Migratory	Schedule 3	Likely*
Fairy tern	*Sterna nereis nereis*	Vulnerable, Marine, Migratory	Schedule 1	Likely*
Crested tern	*Thalasseus bergii*	Marine	not listed	Likely*
Caspian tern	*Hydroprogne caspia*	Marine, Migratory	Schedule 3	Likely*
Eastern reef egret	*Egreta sacra*	Marine, Migratory	Schedule 3	Likely*
Pied cormorant	*Phalacrocorax varius*	Not listed	not listed	Likely*
Pied oystercatcher	*Haematopus longirostris*	Not listed	not listed	Likely*
Pacific gull	*Larus pacificus*	Marine	not listed	Likely*
Silver gull	*Chroicocephalus novaehollandiae*	Marine	not listed	Likely*
South Polar skua	*Stercorarius maccormicki*	Marine, Migratory	Schedule 3	Likely
Southern giant petrel	*Macronectes giganteus*	Endangered, Marine, Migratory	not listed	Likely
Black-browed albatross	*Thalassarche melanophris*	Marine, Migratory	Schedule 1	Likely
Indian yellow-nosed albatross	*Thalassarche carteri*	Marine, Migratory	Schedule 1	Likely
Wedge-tailed shearwater	*Ardenna pacifica*	Marine, Migratory	Schedule 3	Likely*
Fleshy-footed shearwater	*Ardenna carneipes*	Marine, Migratory	Schedule 3	Likely
Hutton's shearwater	*Puffinus huttoni*	Marine, Migratory	Schedule 1	Likely
Little shearwater	*Puffinus assimilis*	Marine	not listed	Likely*
Wilson's storm petrel	*Oceanites oceanicus*	Marine, Migratory	Schedule 3	Likely
White-faced storm petrel	*Pelagodroma marina*	Marine	not listed	Likely*
White-bellied sea eagle	*Haliaeetus leucogaster*	Marine, Migratory	Schedule 3	Likely*
Eastern osprey	*Pandion cristatus*	Marine, Migratory	not listed	Likely*

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

2.4 Shark and Ray Overview

There are several species of shark and ray that have the potential to occur within the vicinity (i.e. less than 50 kilometres) of the MWADZ area. Some of these have conservation status under Commonwealth (EPBC Act) and/or Western Australian (FRMA/WC Act) legislation (refer to Table 4).

Those species, however, that are most likely to be present in the vicinity of the MWADZ, have the potential to 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*).

While the focus has been on the risks associated with these two iconic (and in the case of the white shark, protected) species, the management actions proposed in this plan will be effective for all shark species.

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

Table 4: The conservation status of shark and ray species possibly occurring in the MWADZ proposal area

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	*Carcharias taurus*	Vulnerable	Specially protected fauna (WC Act)	Possible
Whale Shark	*Rhincodon typus*	Vulnerable, Migratory	Totally protected fish (FRMA) Specially protected fauna (WC Act)	Possible
White Shark	*Carcharodon carcharias*	Vulnerable, Migratory	Totally protected fish (FRMA) Specially protected fauna (WC Act)	Likely
Shortfin Mako Shark	*Isurus oxyrinchus*	Migratory	Not listed	Unlikely
Longfin Mako Shark	*Isurus paucus*	Migratory	Not listed	Unlikely
Scalloped Hammerhead	*Sphyrna lewini*	Migratory	Not listed	Possible
Smooth Hammerhead	*Sphyrna zygaena*	Migratory	Not listed	Possible
Green Sawfish	*Prisitis zijsron*	Vulnerable	Totally protected fish (FRMA) Specially protected fauna (WC Act)	Not likely
Giant Manta Ray	*Manta birostris*	Migratory	Not listed	Possible
Tiger shark[3]	*Galeocerdo cuvier*	Not listed	Not listed	Likely

[3] 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 following section provides an overview of the potential environmental stressors that may have an impact on marine fauna within the MWADZ area. 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 potential environmental stressors that were identified to potentially have an impact on marine fauna are:

- physical presence of aquaculture infrastructure;
- 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 PER/EIS.

3.1 Physical Presence of Aquaculture Infrastructure

The physical presence of aquaculture farms has the potential to create barriers to fauna movement if it restricts migratory routes or transit routes of marine mammals, marine reptiles and seabirds between their habitats. The presence of aquaculture infrastructure could also attract larger marine predators including sharks, sea lions and dolphins due to the infrastructure providing Fish Aggregation Device (FAD) effects. Sea-based infrastructures that may have an impact on marine fauna include:

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

Potential impacts to marine fauna related to the physical presence of aquaculture infrastructure 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 aquaculture infrastructure;
- habitat changes due to placement of infrastructure 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 area during the installation of the aquaculture infrastructure and during 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, mooring, etc.).

Higher vessel activity will likely occur during the construction of the aquaculture farms (i.e. installation of sea cages, anchoring and mooring systems) and there will probably be reduced vessel movement during the operational period.

3.3 Artificial Light

Artificial light spill and glow generated during the installation and operation of aquaculture farms within the MWADZ area 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 infrastructure;
- navigation marker lighting; and
- vessel lighting.

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

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

3.4 Noise and Vibration

Noise and vibrations generated during the installation of aquaculture infrastructure and during operational activities within the MWADZ area may have potential impacts on marine fauna. The primary sources of potential noise and vibration generating from the activities 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 the impacts will vary depending on a number of variables, including the frequency range of the emitting noise and its intensity, the receiving environment (e.g. salinity, water depth, and sea bed type), met-ocean conditions, characteristics and sensitivity of the animal, and its distance from the source. Marine fauna which are considered sensitive to underwater noise 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 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 sea cage infrastructure to the seabed. This does not include piling or blasting, as these construction methods are not required for aquaculture operations within the MWADZ.

Noise and vibrations are also likely to be generated by the sea-state conditions and vessel movements undertaken within the aquaculture zone (NSW DPI 2012). Therefore, the MFIMP provides management and mitigation measures designed to reduce noise generated by vessels and other machinery.

3.5 Fish Farming Activities

Fish farming activities within the MWADZ has 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, has the potential to 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 (increaser species, e.g. silver gulls).

4. Mitigation and Management Measures

The potential for impacts to marine fauna associated with anthropogenic interaction are assessed and mitigated under the marine fauna section of the MWADZ Environmental Monitoring and Management Plan (EMMP) and individual operator Management and Environmental Monitoring Plans (MEMPs).

The integrity of significant marine fauna populations are maintained using a combination of best-practice and proactive infrastructure management; and ongoing environmental monitoring by the operators in the MWADZ. Reactive management strategies are also employed to manage incidents as they arise. The approaches to management follow those approved by the Environmental Protection Authority (EPA) for the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan.

4.1 Physical Presence of Aquaculture Infrastructure

Management measures implemented to mitigate and/or manage impacts posed by the presence of aquaculture sea cage infrastructure on marine fauna include:

- Staff and contractors fully trained and inducted in the zone Management Policy to ensure they are fully aware of the protocol for managing interactions with marine fauna.
- All field staff trained in marine fauna identification, to allow for identification and enumeration of marine mammals, turtles and other reptiles sighted within 50 metres (radius) of the sea cage infrastructure and seabirds sighted within 100 metres (radius) of such structures.
- Predator exclusion systems mandatory on sea cages. Operators are required to use durable fish nets (heavy-duty, single barrier) and external anti-predator nets (double barrier) to avoid predation on farmed stock by sea lions, sharks and dolphins.
- Sea cage netting to be inspected daily 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 entanglements of marine fauna.
- Nets, ropes and cages maintained in proper working order; being taught, without fouling, 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 sea cage aquaculture operation. Feeding protocols to be observed to minimise the amount of

uneaten feed entering the surrounding water. To discourage scavenging or predation by marine fauna, dead finfish are to be removed from sea cages on a daily basis and disposed of at appropriate landfill sites on the mainland.

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 cage infrastructure and the accommodation barge]; and
- restrict construction and operational activities to daylight hours.

To minimise potential interactions or vessel strikes with marine fauna, the Master of a vessel operating in the MWADZ is required to:

- 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 15 knots); and
- avoid the use of vessels at night wherever possible.

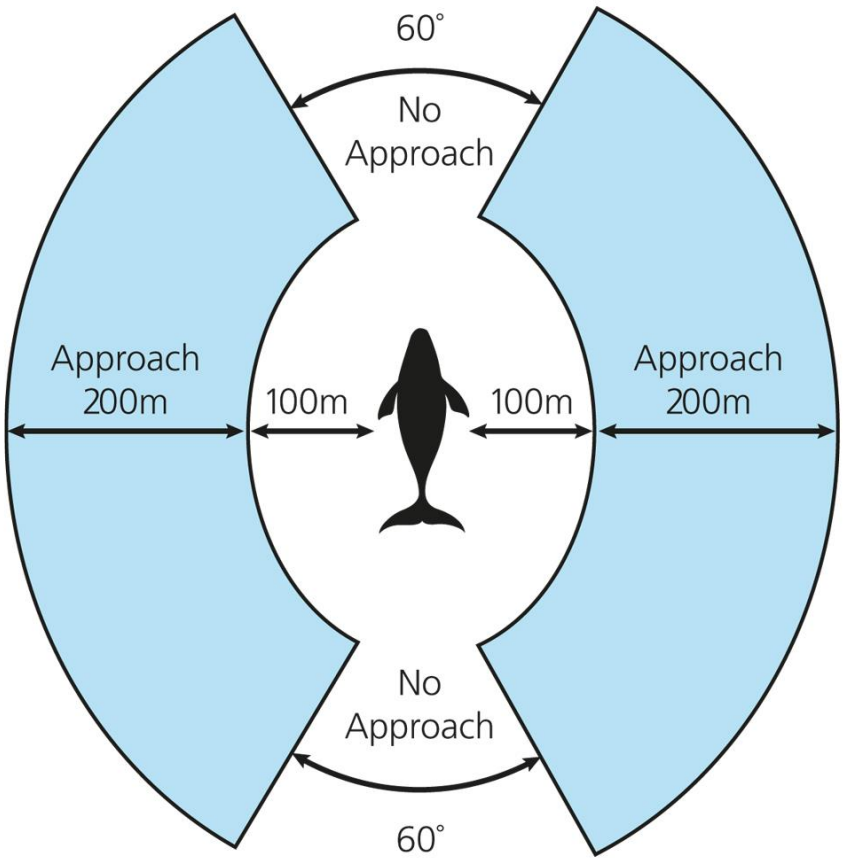


Figure 2: Approach Distances for Marine Fauna (whales = 100 metres, dolphins and turtles = 50 metres)

4.3 Artificial Light

The key management measures and guidelines observed by all staff operating in the MWADZ in order to minimise potential adverse impacts of artificial light on marine fauna include:

- 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 infrastructure (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;

- restrict lighting on moored vessels at night to the minimum required for safe operations; and
- periodic monitoring of the waters around moored service vessels for presence of juvenile sea birds and other marine fauna that may have been affected by light emissions.

4.4 Noise and Vibration

Noise and vibration emissions generated from the aquaculture activities within the MWADZ will be managed by the implementation of mitigation and management measures including:

- routinely maintaining and inspecting noise generating equipment (e.g. vessel engines, drilling equipment) to reduce unnecessary increase in noise levels from the equipment (all vessels shall operate in accordance with the appropriate industry noise codes);
- avoiding the practice of leaving engines, thrusters and auxiliary motors on standby or running mode (where practicable);
- the Master of any aquaculture vessel operating in the area taking note if marine fauna is sighted in the vicinity of the aquaculture infrastructure and reducing speed to minimise noise disturbance (other staff are also responsible for bringing the situation to the attention of the Master of the vessel); and
- fitting sound suppression devices (e.g. mufflers) on noise-emitting equipment (if applicable).

4.5 Fish Farming Activities

The potential impacts associated with fish farming activities on marine fauna will be monitored and managed under the MWADZ EMMP and individual licensee MEMPs. Management and mitigation measures implemented to reduce these potential impacts are outlined below.

4.5.1 Feeding Practices

Feeding activities within the MWADZ area shall be managed in accordance with the following to minimise feed wastage and reduce the potential attraction to and/or reward from sea cages by marine fauna:

- use high-quality pellet feed containing less fish meal and fish oil than traditional aquaculture feeds and designed to sink at rates which optimise consumption by stock;
- primarily storing pellet feed on site in bulk feed hoppers and storing any loose bags of feed in either the below-deck compartment of the supply boat or on-deck covered by heavy duty PVC tarpaulin or similar;

- ensuring staff are 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
- not permitting the feeding of marine fauna within the MWADZ proposal area.

4.5.2 Farm Fish Mortalities

In order to minimise the attraction of marine fauna such as sea lions, dolphins and other predators, including sharks, to the proposed MWADZ area, the following management measures will be implemented:

- dead and moribund stock will be removed daily from the sea cages; and
- all dead fish so removed will be stored in enclosed containers until disposed of at appropriate land-based disposal facilities on the mainland.

4.5.3 Exclusion Devices

Management and mitigation measures that will be implemented to minimise the potential interactions of marine fauna with the sea cage infrastructure include:

- sea cages will be covered with bird netting (of a mesh size 60 millimetre bar-width or less) to prevent seabirds from gaining access to fish feed and stock mortalities inside the sea cages;
- other seabird deterrents (visual and audio) may be used in accordance with the Zone Management Policy, provided the deterrent does not cause any harm to fauna;
- sub-surface exclusion or “anti-predator” netting (with mesh sizes 60 millimetres bar-width or less) will be mandatory on sea cages within the proposed MWADZ;
- durable fish nets (heavy-duty single barrier) and (as required) external anti-predator nets (double barrier) will be used to avoid predation on farmed stock by sea lions, sharks and dolphins;
- sea cage netting must be inspected daily to ensure its integrity is intact, free from debris and maintained to a standard that will minimise marine fauna entanglement;
- sea lion-proof “jump fences”, consisting of mesh netting with a breaking strain rating of at least 300 kilograms and suspended at a minimum of 2.4 metres above the waterline, are to encircle the sea cages to prevent sea lions from hauling out on the cage collar and breaching the barriers to access the sea cages;
- incorporating features such as “false bottom” anti-predator netting or predator-proof metal plate into the sea cage design to prevent sea lions and dolphins from accessing any dead stock at the bottom of the sea cages; and
- tensioning “anti-predator” netting as tight as practical to provide a buffer between the grow-out net and the anti-predator net to avoid any potential access from marine fauna.

5.0 Environmental Project Management

5.1 Induction and Training

Training and induction programmes provide personnel with an understanding of their environmental responsibilities and increase their awareness of the management measures required to reduce potential impacts on the environment. Personnel engaged in the construction and operation of the aquaculture farms are required to attend environmental inductions as part of their site inductions. These inductions will ensure that staff are aware of the importance of marine fauna conservation and emphasis the precautions that need to be observed by personnel to minimise interactions with marine fauna (e.g. sea lions and seabirds).

5.2 Code of Practice

The Aquaculture Council of Western Australia (ACWA) has developed a marine-based finfish Environmental Code of Practice, which has been designed to encourage environmentally-responsible behaviour in the aquaculture industry. This Environmental Code of Practice provides a mechanism to promote ecologically-suitable objectives in the industry and specifies the legal requirements; including the licence conditions imposed under the *Fish Resources Management Act 1994* (FRMA) and the MEMP annual reporting requirements. This document is regularly reviewed with respect to changes in government requirements or community values.

Aquaculture licence operators within the MWADZ area are obligated to operate within the guidelines provided in this Environmental Code of Practice document.

6.0 Monitoring, recording and reporting

6.1 Marine Fauna Monitoring - General

A daily record of all interactions with wildlife will be kept, as detailed below. The template provided in **Appendix 1** is to be used for recording all wildlife sightings, observations and interactions (two worked examples are also provided in this template). A copy of this template will be kept with the vessel log book on-board work vessels at all times. The following observations/interactions with wildlife must be recorded:

- the number of marine mammals, turtles, seabirds, large finfish (such as sharks) and other animals sighted in the area of the sea cages and their observed behaviours;
- all sightings of cetaceans, sea lions, turtles and any other species of conservation significance within 50 metres of the sea cages; and

- any specific interactions with wildlife, such as aggression by wildlife to aquaculture personnel, access of wildlife to sea cages, collision, entrapment, or entanglement of wildlife in aquaculture infrastructure will be recorded by personnel and reported to the site manager.

To enable identification of species of conservation significance, staff will have access to and be familiar with identification guides such as the Australian Fisheries Management Authority's (AFMA) Protected Species Guide (available at http://www.afma.gov.au/wp-content/uploads/2014/12/protected-species-id-guide.pdf and the Department of Parks and Wildlife (DPAW) marine wildlife guide of Southern WA http://www.dpaw.wa.gov.au/images/documents/conservation-management/marine/Marine_Life_of_Southern_WA.pdf. A copy of one of these guides will be kept on board work vessels along with binoculars to aid in the identification of any species of conservation significance sighted.

If turtles and marine mammals are frequently sighted within 500 metres of the sea cages or work vessel routes, a reduced speed will be adopted by work vessels.

If any wildlife is found entangled or entrapped in aquaculture equipment, the cause of interaction will be reviewed and maintenance and operational practices will be adjusted accordingly.

6.2 Marine Avifauna Monitoring - Specific

In addition to the requirements specified in section 6.1, the monitoring that will be undertaken for marine avifauna is as outlined below:

- Interactions between seabirds and sea cage infrastructure will be monitored daily using semi-quantitative approaches.
- An independent seabird expert will be present on site during the initial establishment of the sea cages and at intervals thereafter for the purposes of establishing baseline data and validating monitoring undertaken by fish farm staff.
- An independent expert will develop and facilitate a training program for fish farm staff to continue ongoing seabird monitoring. Particular attention will be paid to surface-feeding silver gulls and Pacific gulls, as well as to sub-surface feeders such as the pied cormorant and wedge-tailed shearwater.
- Responsibility for monitoring of seabird activity will be handed over to the fish farm crew after training. The independent consultant will provide an identification guide for this purpose.
- Fish farm staff will be required to record daily:
    - numbers and species of seabird in the vicinity (i.e. within 100 metres) of the sea cages;
    - types of seabird behaviour (e.g. roosting on floats, feeding on fish food, etc.);

  - location and cause of any entanglement/entrapment incident and the seabird species involved; and
  - incidents of seabirds colliding with any service vessel.
- Where multiple fish farms are operating within the MWADZ, 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 each operator in the MWADZ.
- Based on the success of silver gull exclusion measures, the need to conduct ongoing broad-scale surveys of silver gull populations will be assessed after six and twelve months of operation in consultation with the Office of the Environmental Protection Authority (OEPA).

6.3 Incident Reporting and Response Strategy

6.3.1 Marine Mammals, Turtles and Other Marine Reptiles

The incident reporting and response strategies for incidents within the MWADZ relating to marine mammals, turtles and other marine reptiles include the following:

- All collision or entanglement incidents that may occur with marine fauna will be reported to the DPAW Wildcare Hotline on telephone number: (08) 9474 9055 and the Geraldton DPAW office within 24 hours of the incident occurring and the details of the incident, including the actions taken, will be documented.
- Any incident involving a marine mammal or turtle in distress, including those involving entanglement, collision or stranding, will be reported immediately to DPAW Wildcare Hotline on telephone number: (08) 9474 9055 and the Geraldton DPAW office within 24 hours of the incident occurring.
- Ongoing incidents of entanglement and/or breaching of sea cage netting/barriers will be reported to DPAW and an appropriate management response will be determined in consultation with Office of Environmental Protection Authority (OEPA) and the Department of Fisheries (DoF).
- If marine fauna is discovered distressed due to entanglement/entrapment in aquaculture infrastructure, then all reasonable efforts will be made by fish farm staff to untangle the individual animal. Staff will be encouraged to contact DPAW staff for advice prior to attempting to assist distressed animals. Staff will act only if safe to do so and will not, under any circumstances, put their own safety at risk to assist wildlife in distress.
- A list of emergency contact numbers will be displayed on-board service vessels and work platforms used to service the aquaculture farms.

6.3.2 Marine Avifauna

- Upon discovery of a distressed seabird (entangled or entrapped) in fish farming infrastructure, efforts will be made by staff to release the individual

bird if safe to do so. Entanglements/entrapments of seabirds in fish farming equipment will be reported DPAW Wildcare Hotline on telephone number: (08) 9474 9055 and the Geraldton DPAW office within 24 hours of the incident occurring.

- In the event of a collision between a seabird and aquaculture infrastructure, 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 part of the vessel 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.

6.3.3 Sharks and Rays

The incident reporting and response strategies for incidents within the MWADZ relating to shark and ray species include the following:

- Operators should notify the Department in the event of an entanglement/entrapment by contacting the closest regional office. The report should detail the following information:
  - Species;
  - Size;
  - Location within infrastructure;
  - Behaviour (e.g. agitated).

  The Department will advise on a case by case basis how to best respond and, where necessary, assist in providing all relevant paperwork to allow the appropriate actions to be undertaken.
- If a shark or ray is discovered entangled/entrapped in aquaculture infrastructure, then all reasonable efforts will be made by fish farm staff to untangle the individual animal. However, aquaculture operators should only act if safe to do so and not, under any circumstances, put their own safety at risk.
- For ETP species, while there is no statutory requirement, all collision or entanglement incidents that may occur within Western Australian waters that involve sharks (or rays) listed under the Commonwealth EPBC Act should be reported to the DPAW Wildcare Hotline on telephone number: (08) 9474 9055 and the Geraldton DPAW office within 24 hours of the incident occurring.

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8.0 Appendix 1

Wildlife interaction and sightings template

General information							Species Details							Weather/sea conditions	
Sightings No.	**Date**	**Time** (24 hour)	**Animal seen from** (land/vessel/ sea cage)	**Latitude** (degrees and decimal minutes)	**Longitude** (degrees and decimal minutes)	**Your activity** (feeding/ net maintenance / transport)	**Species –** using identification guides	**How sure?** (very sure/ sure/ not sure)	**Total no of animals**	**Description of sighting and animals behaviour**	**Other animals present** (including fish, birds, etc.)	**Other notes**	**Photo /video taken ?** (Y/N)	**Sea State** (see Beaufort table below)	**Overall visibility**
1	30/1/15	08:45	Vessel	17 43 0 E	121 57 0 S	transport	Humpback whale	Sure	4	Breaching	Lots of small tuna	None	Yes	2	
2	2/4/15	12:30	Sea cage	14 52 0 E	121 60 0 S	feeding	Silver gulls	Very sure	50	Flying/circling over sea cages	none	Some birds attempting to access feed	No	3	
3															
4															

Sea state (Beaufort Number) descriptions

Beaufort Number	Wind Speed (knots)	Wind Description	Specification for use on land
0	Less than 1	mirror calm	Sea like a mirror
1	1 to 3	light air	Ripple with the appearance of scales are formed, but without foam crests
2	4 to 6	light breeze	Small wavelets still short, but more pronounced. Crests have a glassy appearance and do not break.
3	7 to 10	Small wavelets	Large wavelets. Crests begin to break Foam of glassy appearance. Perhaps scattered white horses.
4	11 to 16	gentle breeze	Small waves, becoming larger; fairly frequent white horses
5	17 to 21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray
6	22 to 27	Strong breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray
7	29 to 33	Near gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind
8	34 to 40	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	41 to 47	Severe gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.
10	48 to 55	Storm	Very high waves with long overhanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance
11	56 to 63	Violent storm	Exceptionally high waves (small and medium-size ships might be for a time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind.
12	More than 63	Cyclone/hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected

(Sourced from Worley Parsons 2008)