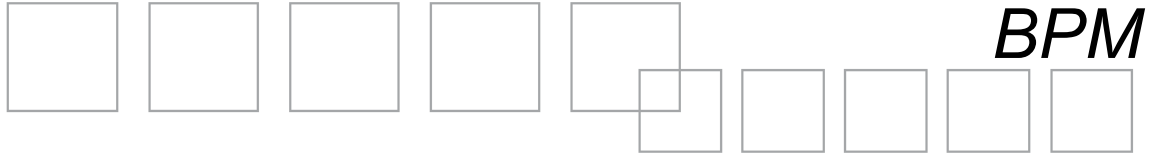


Appendix 12 – Independent Fauna Observer (IFO) Phase 1 Review.



Prepared for

Woodside Energy Limited

**Independent Fauna Observer Report for the Pluto LNG
Development Project**



Project Number OC00003388

14 July 2008

Revision 0

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This document may only be used for the purpose for which it was commissioned; and in accordance with the Terms of Engagement for the commission.

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Cover photographs: Top left: Phoenix Cutter Dredge (Photo Peter Long, Woodside); Middle: Cornelis Zanen, Trailer Suction Hopper Dredge (Photo David Paton BPM); Bottom right: Hoppopotes, Excavator (Photo David Paton, BPM).

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1. Executive Summary

Woodside Energy Limited undertook dredging activities associated with the Pluto LNG Development in Mermaid Sound off Dampier, Western Australia between November 2007 and June 2008.

As part of their environmental mitigation procedures for the project, Woodside commissioned Blue Planet Marine (BPM) to assist with supplying an Independent Fauna Observer (IFO) for the period of the project that coincides with peak turtle nesting activity in the area (November – April). The role of the IFO was to coordinate the formal inductions of the dredge crews and associated vessel personnel, the implementation of fauna observer training, and coordination of mitigation activities for potential impacts on marine fauna associated with the Pluto Dredging Program.

A total of 171 sightings of marine fauna involving a total of 487 marine animals were reported associated with the Pluto LNG Development Project between 19 November 2007 (the commencement of dredging operations) and the 26 April 2008 (last IFO site visit). Of these sightings, 136 (80%) sightings were dolphin pods (including bottlenose dolphins (*Tursiops aduncus*), Indo-Pacific humpback dolphin (*Sousa chinensis*) and the first confirmed sighting of snubfin dolphin (*Orcaella heinsohni*) south of Broome. This latter sighting is an extension of their known range on the west coast of Australia. Twenty eight (16%) sightings were turtles (including green turtles (*Chelonia mydas*) and other unidentified turtle species), 1 (0.5%) sighting was a dugong (*Dugong dugon*) and a further 6 (3.5%) sightings were of other marine fauna including manta rays (*Manta birostris*), sea snakes (Olive sea snake (*Aipysurus laevis*)) and sharks (including tiger shark (*Galeocerdo cuvier*)). No whales were sighted during the report period. A single interruption to dredging operations occurred due to a manta ray (which is not a prescribed species for interruptions to dredging operations) and the work was carried out in full adherence to the agreed impact mitigation procedure for marine mammals and turtles for the project.

Woodside's dredging contractors (Boskalis Australia and Van Oord) were found to be diligent in their adherence to: (i) the DEWHA and WA EPA requirements in relation to marine fauna interactions; (ii) the Pluto LNG Development Sea Turtle Management Plan; and, (iii) the implementation marine fauna impact mitigation components of the Pluto LNG Development Dredging and Spoil Disposal Management Plan/Environmental Management Plan.

2. Introduction

Woodside Energy Limited (hereafter referred to as Woodside) is in the process of developing the Pluto gas field (approximately 190km north-west of Karratha, WA) to produce liquefied natural gas for export. The Pluto field was discovered in April 2005 in the Carnarvon Basin, and is operating under exploration permit WA-350-P. The field is owned 100% by Woodside. Water depth at the field ranges from approximately 400m to 1000m. The field is estimated to contain 4.1 trillion cubic feet of dry gas (Woodside 2006).

Woodside's Pluto LNG Development proposal is extensive and includes an offshore production system, offshore platform, a pipeline approximately 200km to shore, an onshore gas processing plant, storage facilities and an export jetty. The onshore facilities are planned to be built within the Burrup Industrial Estate close to Karratha, between the existing North West Shelf Venture gas plant and the Dampier Port facilities. The Dampier Port lies within Mermaid Sound on the north west coast of Australia (See **Figure 1**). The facilities associated with the Pluto LNG Development will take approximately 36 months to construct from commencement in the fourth quarter of 2007.

Woodside undertook an environmental assessment process for the Pluto LNG Development Project (SKM/Woodside 2007a, 2007b). During this process it was identified that the proposed activities associated with the dredging component of the project had the potential to have an impact on marine fauna within the region. The activities which were identified to have a potential impact included:

- Dredging for a trunkline installation, a navigation channel, a berthing pocket, and a vessel turning basin in Mermaid Sound;
- Potential drill and blasting for jetty construction and shore crossing, in the vicinity of Holden Point;
- Dredge spoil disposal both within and outside of Mermaid Sound;
- Rock fill for trunkline stabilisation;
- Construction of LNG and condensate storage and export facilities on Site A;
- Operation of the LNG and condensate storage and export facilities on Site A; and
- Vessel movement during all phases of the project.

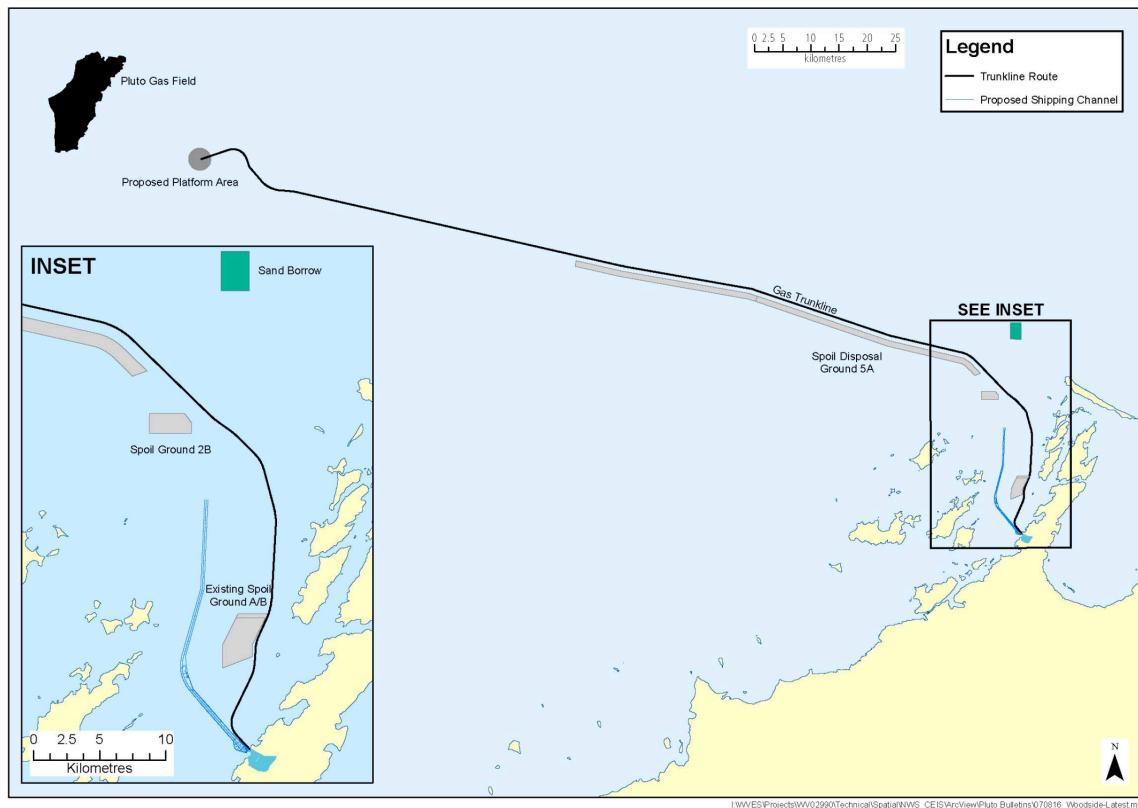


Figure 1 Overview of Pluto LNG Development (Source: Pluto Dredging and Spoil Disposal Management Plan)

Woodside developed a number of strategies to minimise impacts on the marine environment during dredging operations. These strategies are identified in the Pluto LNG Development Sea Turtle Management Plan (STMP) and the Pluto LNG Development Dredging and Spoil Disposal Management Plan/Environmental Management Plan (DSDMP/EMP).

As part of their environmental mitigation procedures for the project, Woodside commissioned Blue Planet Marine (BPM) to assist with (i) supplying an Independent Fauna Observer (IFO) to coordinate the formal inductions of the dredge crews and associated vessels, (ii) the implementation of fauna observer training, and (iii) coordination of mitigation activities for potential impacts on marine fauna associated with the Pluto Dredging Program.

This report identifies activities undertaken by the IFO and reports on marine fauna sightings during the period 19th November 2007 (i.e. the commencement of dredging activities) to the 26th

April 2008 (i.e. the last IFO site visit). This period covers the peak turtle nesting activity on the north west coast of Western Australia.

3. Regulatory Requirements

The Pluto LNG Development project is located on the north west coast of Western Australia. Due to the nature and area of operation of the project, the development was required to comply with International, Commonwealth and State legislative requirements. Relevant statutes and regulations include:

- *Environment Protection (Sea Dumping) Act 1981* (Commonwealth (Cwth));
- *Environment Protection (Sea Dumping) Regulations 1983* (Cwth);
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cwth);
- *Wildlife Conservation Act 1950* (Western Australian State (WA));
- *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cwth);
- *Australian Quarantine Regulations 2000* (Cwth);
- *Environmental Protection Act 1986* (WA);
- *Pollution of Waters by Oil and Noxious Substances Act 1987* (WA);
- *Port Authorities Act 1999* (WA);
- *Shipping Pilotage Act 1967* (WA);
- *Marine and Harbours Act 1981* (WA); and
- *International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978 relating thereto (MARPOL 73/78).*

Woodside obtained the relevant environmental approvals for the Pluto LNG Development from:

- The Commonwealth Department of the Environment, Water, Heritage and Arts (DEWHA) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC 2006/2968 – Approval Dated 12 October 2007); and,
- The Western Australian Minister for the Environment and Climate Change under the *Environmental Protection Act 1986* (Approval Dated 3 September 2007).

These approvals are conditional on the Pluto LNG Development being conducted in accordance with a range of environmental conditions specified in Appendices 1 and 2.

One of the conditions was the development of the Sea Turtle and Marine Mammal Management Plan and a Dredging and Dredge Spoil Management Plan for managing the impacts of the dredging and associated activities on the environment. These plans specify the objectives for the position of the IFO.

4. Objectives of the IFO

The two main objectives of the IFO for the Pluto LNG Development are:

1. assist Woodside to comply with all legislative requirements regarding the protection of marine turtles and marine mammals while carrying out near shore dredging operations associated with the Pluto LNG Development Project;
2. assist Woodside with the implementation of the Pluto Sea Turtle Management Plan.

More specifically, the second overall objective includes:

- Input into inductions on fauna observations and requirements of the Pluto Sea Turtle Management Plan;
- Provide training of identified fauna spotters for fauna observations;
- Undertake a one day field inspection on a fortnightly basis during peak turtle nesting season to conduct additional inductions and/or training if necessary and perform the role of an IFO for the day. This is to ensure compliance with fauna observation procedures in relation to dredging and blasting and vessel operations;
- Undertake an independent review of the implementation of the Turtle Management Plan and fauna observations; and
- Provide Woodside with reports to meet DEWHA and WA State Government requirements regarding the observation and occurrence of marine fauna species encountered during dredging and associated activities, including completed DEWHA Whale and Dolphin Sighting reporting requirement for each cetacean sighting.

5. Description of the Environment

Several sensitive marine species and habitats are known to occur in the vicinity of the dredging and spoil disposal activities (SKM/Woodside 2007b). A number of these marine species are

known to use the area as part of their migration and/or breeding cycles. Key sensitive marine species and habitats include:

- Coral and coral habitats;
- Dugong and dugong habitats;
- Humpback whales; and
- Marine turtles and nesting beaches.

The marine mammal and sea turtle populations of the North West have not been extensively studied (Pendoley 2005a). Those marine mammal and sea turtle species expected to be present in the survey area were determined by a search of the *EPBC Act Protected Matter Interactive Search Tool*. This list of species is shown in **Table 1**.

A total of 12 cetacean, five turtle and one sirenian species are potentially found within, and adjacent to, Mermaid Sound. Data from the Woodside LNGV dredging program undertaken during in 2005-2006 indicates that dolphins (of unconfirmed species) were the most common marine fauna observed throughout the year (Appendix 1). Whales (most probably humpback whales) are observed in the area during the austral winter and spring months (Jenner *et al.* 2001). The bulk of sightings occur between September and November when the whales tend to utilise inshore shore waters and sheltered bays, such as Mermaid Sound during the southern migration (Jenner *et al.* 2001). Turtles utilise the near shore waters of Mermaid Sound throughout the year, with the bulk of sightings in the austral summer months (SKM/Woodside, 2007a). This is consistent with nesting activity during this time of year. There are a number of records of turtles nesting on beaches (e.g. Holden beach, No Name beach) adjacent to the proposed onshore facilities (i.e. Site A) on Burrup Peninsula during the summer months (Pendoley 2005, 2006). **Table 2** indicates seasonal timing of key environmental sensitivities associated with the dredging component of the project.

Table 1 Marine Mammal and Turtle Species Expected to Occur in the Survey Area

Common Name	Scientific Name	Status
Marine Mammals		
<i>Cetaceans</i>		
Blue Whale	<i>Balaenoptera musculus</i>	Endangered, Migratory
Humpback whale	<i>Megaptera novaeangliae</i>	Vulnerable, Migratory
Bryde's Whale	<i>Balaenoptera edeni</i>	Migratory
Minke Whale	<i>Balaenoptera acutorostrata</i>	Migratory
Killer Whale, Orca	<i>Orcinus orca</i>	Migratory
Risso's Dolphin	<i>Grampus griseus</i>	Cetacean
Indo-Pacific Humpback Dolphin	<i>Sousa chinensis</i>	Migratory
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	<i>Tursiops aduncus</i>	Cetacean
Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin	<i>Tursiops aduncus</i>	Cetacean
Spotted Dolphin, Pantropical Spotted Dolphin	<i>Stenella attenuata</i>	Migratory
Bottlenose Dolphin	<i>Tursiops truncatus s. str.</i>	Cetacean
Common Dolphin	<i>Delphinus delphis</i>	Cetacean
Sirenians		
Dugong	<i>Dugong dugon</i>	Migratory
Turtles		
Loggerhead Turtle	<i>Caretta caretta</i>	Endangered, Migratory
Green Turtle	<i>Chelonia mydas</i>	Vulnerable Migratory
Leathery Turtle, Leatherback Turtle,	<i>Dermochelys coriacea</i>	Vulnerable Migratory
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Vulnerable Migratory
Flatback Turtle	<i>Natator depressus</i>	Vulnerable Migratory

Source: A search of the EPBC Act Protected Matter Interactive Search Tool with Search Coordinates of -20.3967, 116.4486, -20.7193,116.4486, -20.7193,116.8850, -20.396,116.8850

Table 2 Seasonal Timing of Key Environmental Sensitivities

	2007		2008												2009													
	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D		
Adult turtles mating*	Dark	Dark	Dark	Light								Light	Dark	Dark	Dark	Dark	Light						Light	Dark	Dark	Dark		
Adult turtles nesting and internesting*	Light	Dark	Dark	Dark	Light							Light	Dark	Dark	Dark	Light							Light	Dark	Dark	Dark		
Turtle egg development*	Light	Dark	Dark	Dark	Dark	Light							Light	Dark	Dark	Dark	Light							Light	Dark	Dark		
Hatchling emerging*		Light	Dark	Dark	Dark	Dark	Light							Light	Dark	Dark	Dark	Dark	Light							Light		
Resident foraging turtles*	Year round																											
Humpback whale migration**									Light	Dark	Dark	Light									Light	Dark	Dark	Light				
Coral spawning	Light	Light		Light	Dark	Light						Light	Light		Light	Dark	Light							Light	Light	Light		

Notes:

- For environmental sensitivities: light grey shading = increased activity; dark grey shading = peak activity (sea turtle activity refers to green and flatback turtles, hawksbill turtles).
- For coral spawning, shaded areas show months where coral spawning may occur.
- References: *Pendoley 2006; ** Jenner et al. 2001
- (Source: Pluto LNG Development Dredging and Spoil Disposal Management Plan/Environmental Plan)

6. Independent Fauna Observer Site Inspections

The BPM IFO undertook a total of 11 site inspections between the 19th November 2007 (i.e. commencement of dredging operations for the Pluto LNG Development Project) and 30th April 2008 (i.e. the end of the peak turtle nesting season). Activities undertaken during site inspections included:

- Conducting environmental inductions for dredge crew;
- Training of dredge operators and bridge crew as marine fauna observers;
- Undertaking fauna observations during dredging operations while on site;
- Undertake an independent review of the implementation of the STMP and fauna observations;
- Address other environmental issues as required;
- Undertake an inspection of turtle nesting on Holden beach and No Name beach and development of a Turtle Nesting Contingency Plan; and
- Development of a draft injured marine fauna management protocol.

Site inspections by the IFO were undertaken on dates indicated in **Table 3**.

Table 3 Dates and BPM IFO Personnel for Pluto IFO Site Inspections

Field inspection number	Dates	BPM IFO
1	19-21 November 2007	David Paton
2	6 December 2007	Wayne Pellow
3	19 December 2007	David Paton
4	1-2 January 2008	David Paton
5	16-17 January 2008	Wayne Pellow
6	29-31 January 2008	David Paton
7	13-15 February 2008	David Paton
8	28-29 February 2008	David Paton
9	13-14 March 2008	David Paton
10	14-15 April 2008	David Paton
11	26 April 2008	David Paton

The IFO field inspection programmed for the end of March was rescheduled due to the coral spawning event that took place in late March 2008. This event led to the suspension of dredging works on the Pluto project.

7. Pluto Dredging Environmental Inductions and Marine Fauna Observer Training

One of the conditions of consent for the Pluto LNG dredging programme was that Woodside was required to undertake a Dredging Environmental Induction for all personnel involved in the dredging and associated activities (i.e. survey and support vessels). Inductions were also identified as being required in the Dredging and Spoil Disposal Management Plan/Environmental Management Plan and the Sea Turtle Management Plan. The induction presentation was developed by BPM in consultation with Woodside Environmental personnel, Vivien Wong and Nick Jones.

During the fortnightly site visits by the IFO, a total of 34 Pluto Dredging Environmental Inductions were delivered to a total of 217 personnel involved in the Pluto Dredging project. During periods when the IFO was not on site and new dredging personnel joined the project, the HSE Managers for the dredging companies (i.e. Boskalis, Van Oord) were supplied a copy of the presentation for inductions of new personnel. A copy of the IFO Pluto Dredging Environmental induction presentation is attached in **Appendix 2**.

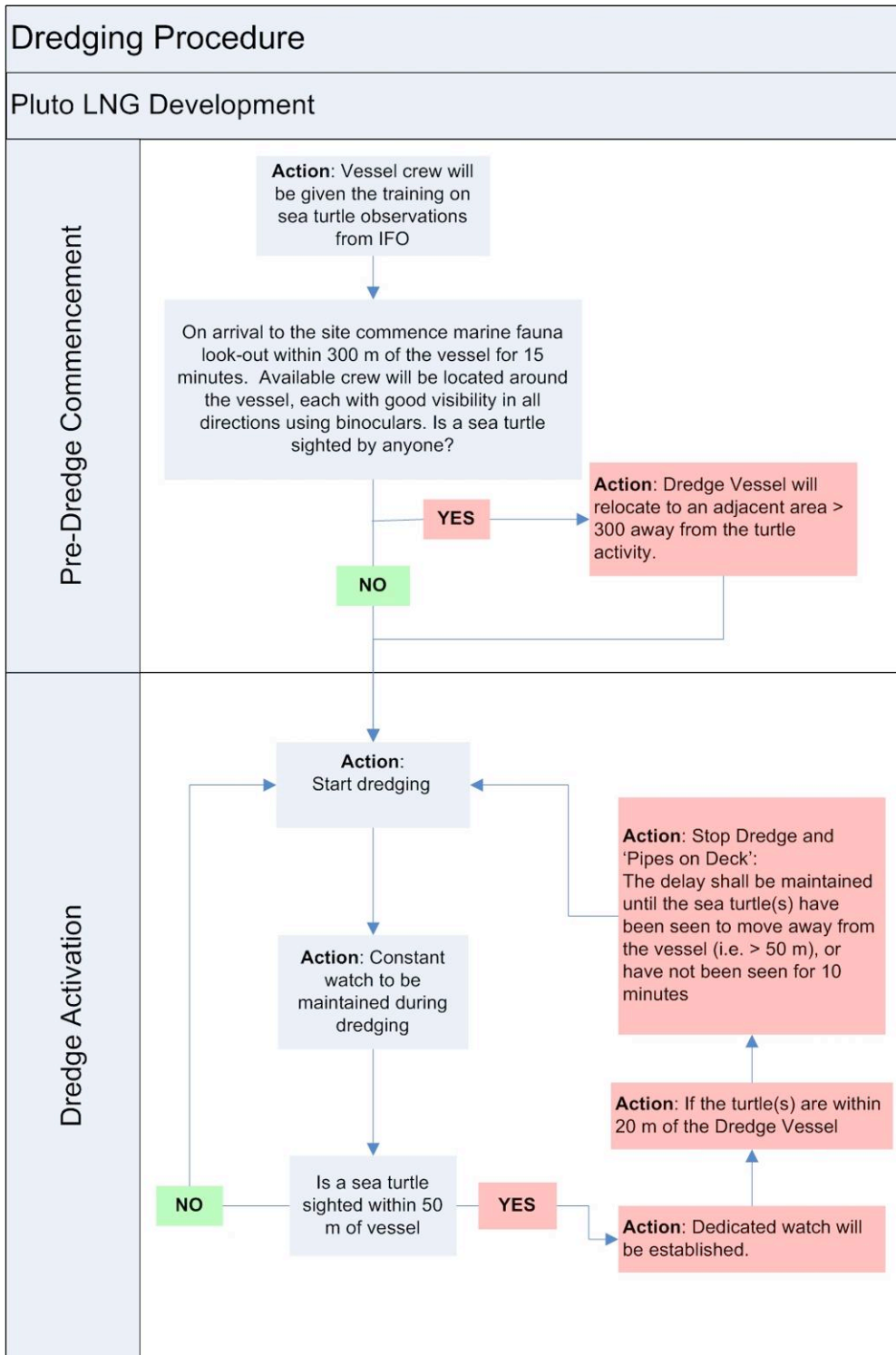
As identified in the Sea Turtle Management Plan, the IFO also undertook Marine Fauna Observer Training of identified dredge operators, bridge crew and crew of vessels involved in undertaking observations required for blasting activities. A total of 18 Marine Fauna Observer Training sessions were run involving a total of 92 personnel involved in the Pluto LNG Dredging Project. A copy of the IFO Pluto Dredging Marine Fauna Observer training presentation is attached in **Appendix 3**.

8. Marine Fauna Impact Mitigation Protocols

Woodside developed a number of strategies to minimise impacts on the marine environment during dredging operations. These strategies are identified in (i) the STMP and (ii) the DSMP/EP.

The impact mitigation strategies developed for minimising potential impacts on turtles and marine mammals are summarised in **Figures 2, 3, and 4**. These strategies were implemented during all dredging and associated activities during the Pluto LNG Development Dredging operations.

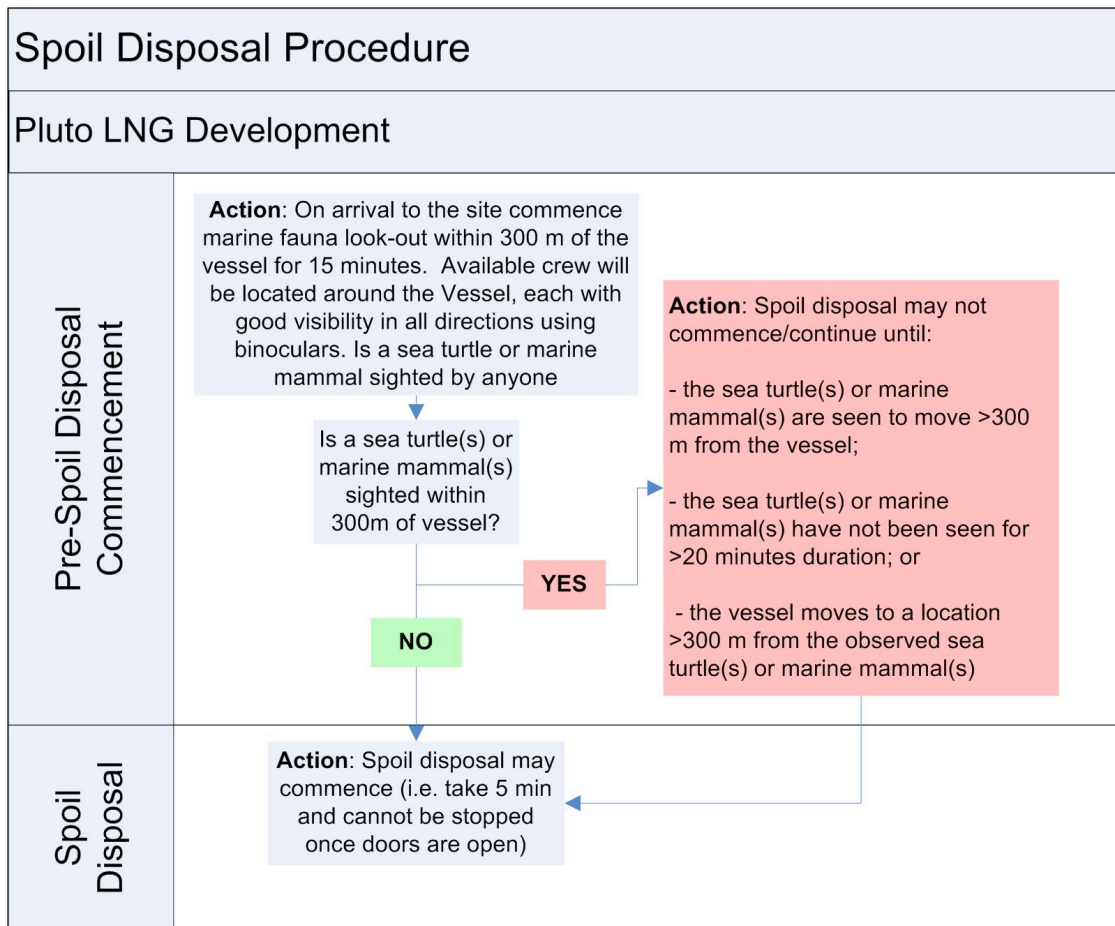
Figure 2 Dredging Procedures



Note: This protocol was updated once dredging activities had commenced as the original did not include marine mammals which was an omission.

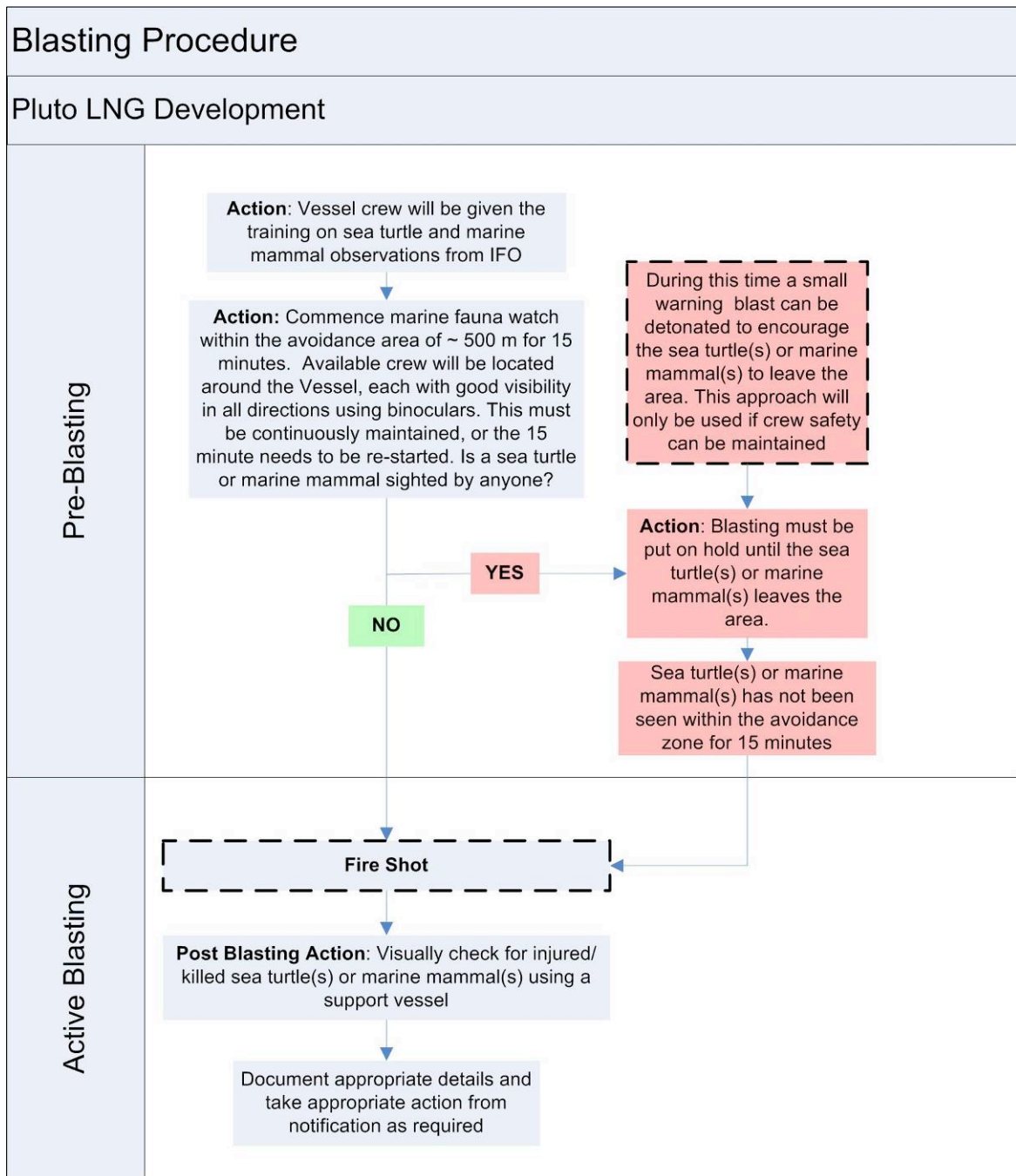
Source STMP (Woodside/SKM 2007a)

Figure 3 Spoil Disposal Procedures



Source STMP (Woodside/SKM 2007a)

Figure 4 Blasting Procedures



Source STMP (Woodside/SKM 2007a)

9. Dredging Operations

A total of eleven vessels were actively involved in the dredging operations and associated activities between 19 November and 30 April 2008. The dredging vessels included:

- Cornelis Zanen (Trailer Suction Hopper Dredger – operated by Boskalis)
- Phoenix (Cutter Dredge – operated by Boskalis); and
- Hippopototes (Excavator – operated by Van Oord).

A full list of vessels and their role within the project is shown in **Table 4**.

Table 4 Vessels involved in the Pluto LNG Dredging Project

Vessel Name	Vessel Type/Activity
Adrenalin Sprint	Survey and crew vessel for Hippo
Cornelis Zanen (also know as the Coza)	Trailer Suction Hopper Dredge
Hippopototes (also know as the Hippo)	Excavator
Mermaid Arrow	Survey Vessel
Mermaid Boss	Barge support vessel for the Phoenix
Miclyn Legend	Support vessel for the Phoenix
Ocean Eagle	Crew and support vessel Phoenix/Coza
Phantom	Crew and support vessel Phoenix/Coza
Phoenix	Cutter Dredge
PT Kotor	Tug for barges Murray and Yarra and support vessel for the Hippo
Samson 101	Support vessel for the Phoenix

Appendix 4 provides a summary of dredging activity, including down time for bad weather and the interruption to dredging activity during the coral spawning event at the end of March 2008 as per the conditions of consent for the project.

10. Marine Fauna Observed

Between 19 November 2007 and 26 April 2008 a total of 171 sightings, comprising a total of 487 marine animals, were reported in the area of operation of the Pluto LNG Development Project. Dolphins were the most commonly observed marine fauna with a total of 136 (80%) sightings of dolphin pods. These included bottlenose dolphins, Indo-Pacific humpback dolphin and the first confirmed sighting of snubfin dolphin south of Broome. This latter sighting is an extension of their known range on the west coast of Australia. Of the remaining sightings, 28 (16%) were turtles (including green turtles and other unidentified turtle species), 1 (0.5%) sighting of dugong, and a further 6 (3.5%) sightings of other marine fauna including manta rays, sea snakes (Olive sea snake) and sharks (including tiger shark). No whales were sighted during the reporting period.

A full list of species seen included:

- **Cetaceans**
 - Bottlenose Dolphins (*Tursiops aduncus*),
 - Indo-Pacific Humpback Dolphin (*Sousa chinensis*),
 - Snubfin Dolphin (*Orcaella heinsohni*),
- **Sirenians**
 - Dugong (*Dugong dugong*),
- **Reptiles**
 - **Turtles**
 - Green turtle (*Chelonia mydas*)
 - other turtles (species unconfirmed)),
 - **Seasnakes**
 - Sea snakes (Olive sea snake (*Aipysurus laevis*))
- **Fish**
 - Manta ray (*Manta birostris*),
 - Tiger shark (*Galeocerdo cuvier*)
 - Unidentified shark species.

Table 5 indicates the number of sightings by marina fauna taxa, the total number of animals sighted, average pod/group size and percentage of all sightings. This data is shown graphically in

Figures 5 and 6.

A full list of marine fauna sightings, closest approach distances, mitigation activities undertaken, visibility and seastate are shown in **Appendix 5**. This data is shown graphically in **Appendix 6** and the location for each reported sighting is shown in **Appendix 7**.

Table 5 Number of sightings by marina fauna taxa, the total number of animals sighted, average pod/group size and percentage of all sightings

Species	Number of sightings reported	Total number of animals reported	Average pod/group size (Range)	Percentage of all sightings
Dolphins	136	449	3.3 (1-20)	80%
Dugong	1	1	1.0 (1)	< 1%
Manta rays	4	5	1.3 (1-2)	2%
Sea snakes	1	1	1.0 (1)	< 1%
Tiger Sharks	1	1	1.0 (1)	< 1%
Turtles	28	30	1.1 (1-2)	16%
Total	171	487		100%

Figure 5 Total number of sighting by fauna group

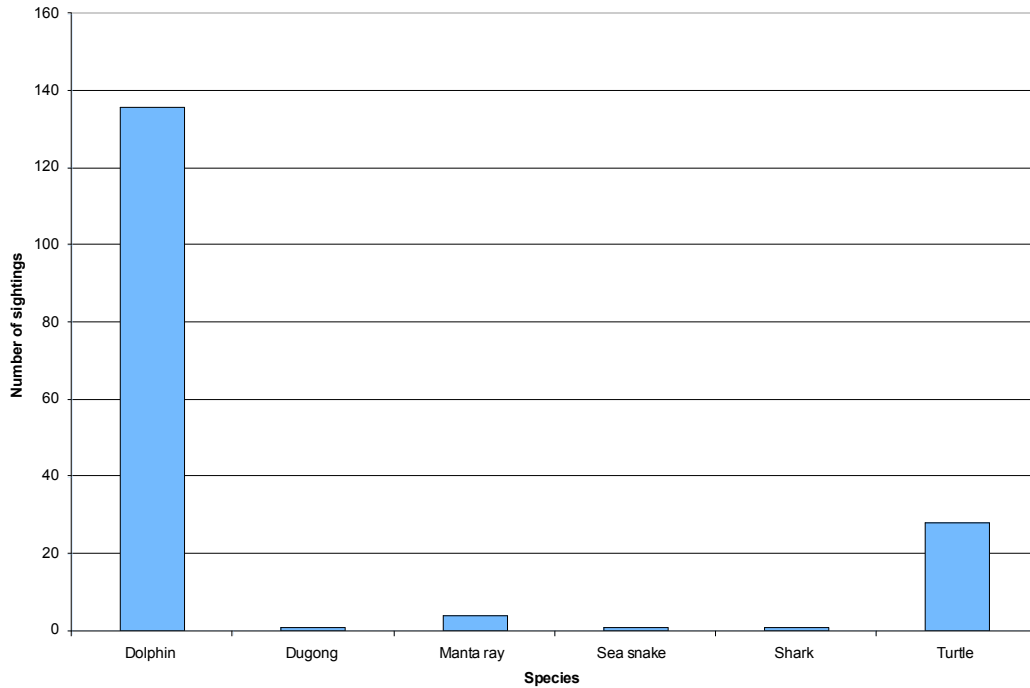
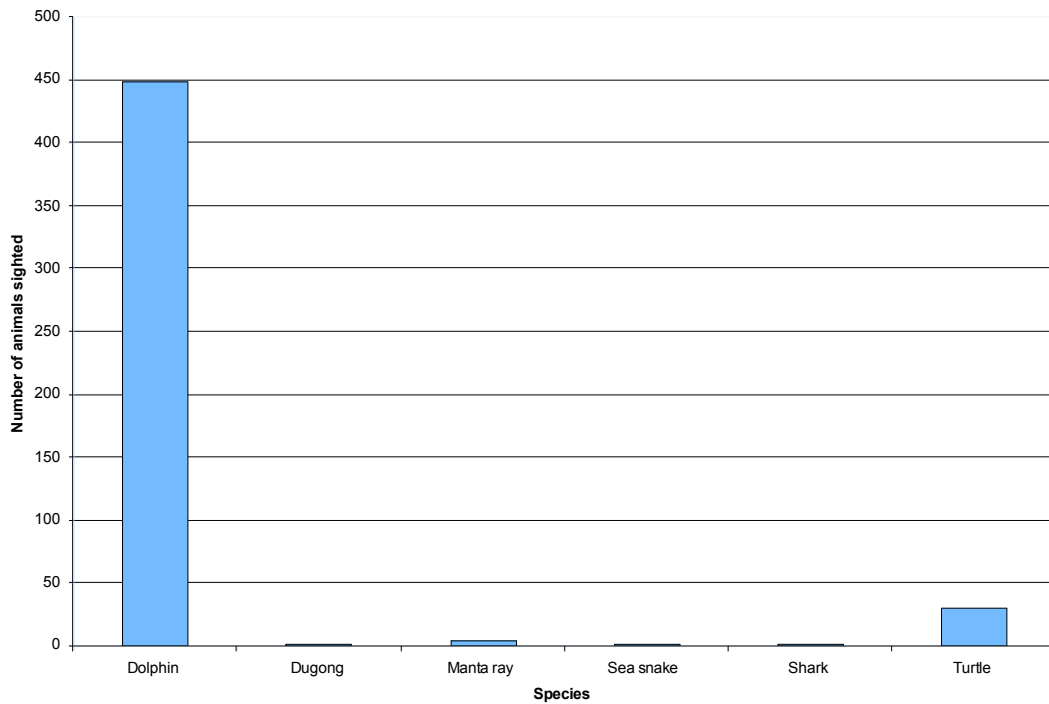


Figure 6 Total number of animals sighted by species



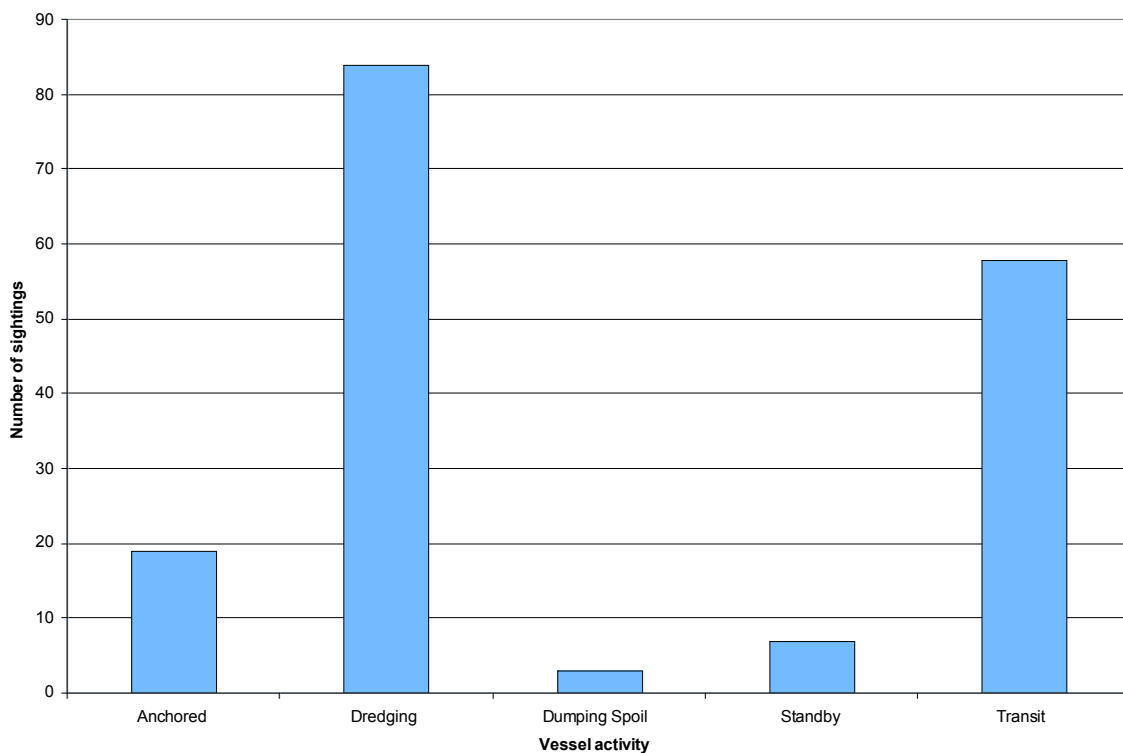
A number of bottlenose dolphins had distinguishing features (i.e. scars or distinctive notches in the dorsal fin), which made it possible to identify individuals. The IFO was able to identify the same individual dolphins on several occasions during site visits. This suggests that a number of

individuals may be resident within Mermaid Sound, at least for during the period of IFO site inspections. Bottlenose dolphins were regularly seen foraging for food on the edge of the dredging plume.

The sightings are not independent and may include multiple reports of the same individual or group, especially when more than one vessel was working in close proximity to each another. Therefore it is not possible to accurately estimate the number of dolphins present in the area over the reporting period, other than to say that they were commonly present. A mark-recapture photographic study would be required to determine the actual number of individuals that utilise the area.

Almost half of sightings were reported during dredging operations (49%) and a third from vessels transiting (34%) (**Figure 7**). A high percentage (>80%) of sightings reported during dredging activities were of dolphins undertaking activities that were consistent with foraging on the edge of the plume for food disturbed during the dredging operations.

Figure 7 Number of marine fauna sightings by vessel activity

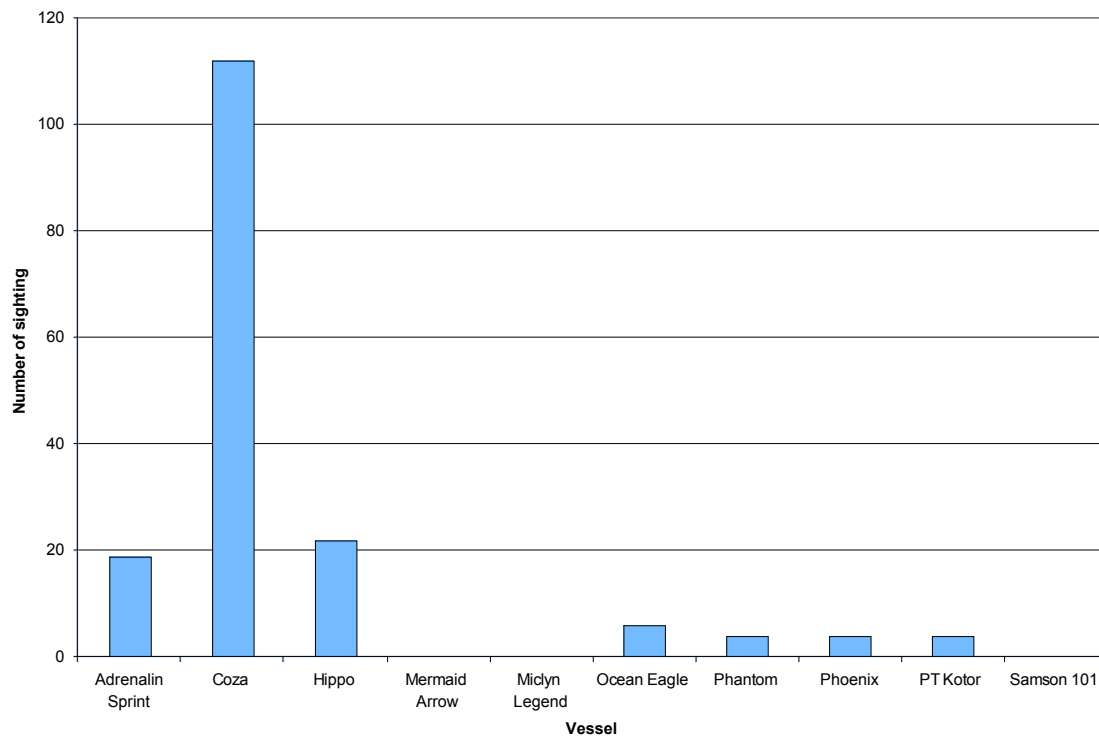


The Cornelis Zanen reported the highest number of marine fauna sightings (n = 112; 66% of all sightings), followed by the Hippopototes (n = 22 ; 13%) and the Adrenalin Sprint (n = 19; 11%). The cutter dredge the Phoenix only reported 4 sightings (2%). **Table 6** and **Figure 8** provide a full breakdown of marine fauna sightings by vessel.

Table 6 Marine fauna sightings by vessel

Vessel Name	Vessel Type/Activity	Number of sighting	% of all sightings
Adrenalin Sprint	Survey and crew vessel for Hippo	19	11
Cornelis Zanen (also know as the Coza)	Trailer Suction Hopper Dredge	112	66
Hippopototes (also know as the Hippo)	Excavator	22	13
Mermaid Arrow	Survey Vessel	0	0
Mermaid Boss	Barge support vessel for the Phoenix	0	0
Miclyn Legend	Support vessel for the Phoenix	0	0
Ocean Eagle	Crew/support vessel Phoenix/Coza	6	4
Phantom	Crew support vessel Phoenix/Coza	4	2
Phoenix	Cutter Dredge	4	2
PT Kotor	Tug for Barges Murray and Yarra and support vessel for the Hippo	4	2
Samson 101	Support vessel for the Phoenix	0	0
Total		171	100

Figure 8 Marine fauna sighting by vessel



10.1 First sighting of snubfin dolphin in the region

An interesting report was received of a sighting of a pod of snubfin dolphins from the Boskalis Marine Superintendent for the Phoenix on the 15 April 2008. He reported observing a pod of 3 unusual looking dolphins from the Phoenix, which was not engaged in dredging operations at the time. He observed the pod of 3 dolphins from the Phoenix for a period of approximately 5 minutes. During this period he had a good view of the dolphins from a distance of approximately 50m and was able to see the head of the animals clearly on a number of occasions. This species has a distinctive head compared to other dolphin species in the region (see **Figures 9** and **10**).

The species was confirmed later that day after consulting reference material in conjunction with the BPM IFO who was on site, but not on the Phoenix, at the time of the sighting. Snubfin dolphins have not been recorded further south than Roebuck Bay in Broome (approximately 345nm north of Mermaid Sound), however areas south of Broome have not been surveyed properly. Sightings off Dampier would extend their known range on the west coast of Australia (*pers. comms.* Guido Parra - Postdoctoral Fellow, School of Veterinary Science, University of Queensland)

The sunbfin dolphin is Australia's only endemic dolphin species. This species was only discovered in 2005 as until this time the snub fin was thought to be an Irrawaddy dolphin. Irrawaddy dolphins are found in coastal areas and major rivers of south-east Asia, and are in serious decline. Little is known about the current population status of the snubfin dolphin. They are an inshore species which are vulnerable to human activities in and around coastal areas.

Figure 9 Snubfin Dolphins



Note: photographs not taken at Dampier. (photo courtesy of Guido Parra)

Figure 10 Snubfin Dolphins



Note: photographs not taken at Dampier. (photo courtesy of Guido Parra)

11. Interruptions to Dredging operations due to Turtles and Marine Mammals

There were no reported interruptions to dredging operations due to sightings of turtles or marine mammals during the Pluto LNG dredging project between 19 November 2007 and 26 April

2008. However there was an interruption to dredging operations on the 15 April 2008 due to a manta ray being within 20m of the bucket of the excavator on the Hippopotoes. Although not required to cease operations for a manta ray, the excavator operator ceased operations until the manta ray was at a safe range from the excavator. There were a number of other incidents that resulted in a loss of operating time due to vessels in transit (mainly support vessels) altering course (n = 7) or slowing down (n = 1) to avoid marine fauna.

12. Factors Affecting Marine Fauna Sightings

12.1 Environmental conditions

Environmental conditions can impact on the ability to sight cetaceans and other marine fauna at sea. Sea state, as represented by the Beaufort scale, is the factor that can potentially have the most significant effect on the sighting rate of marine fauna. Other factors include haze, cloud cover, precipitation and glare.

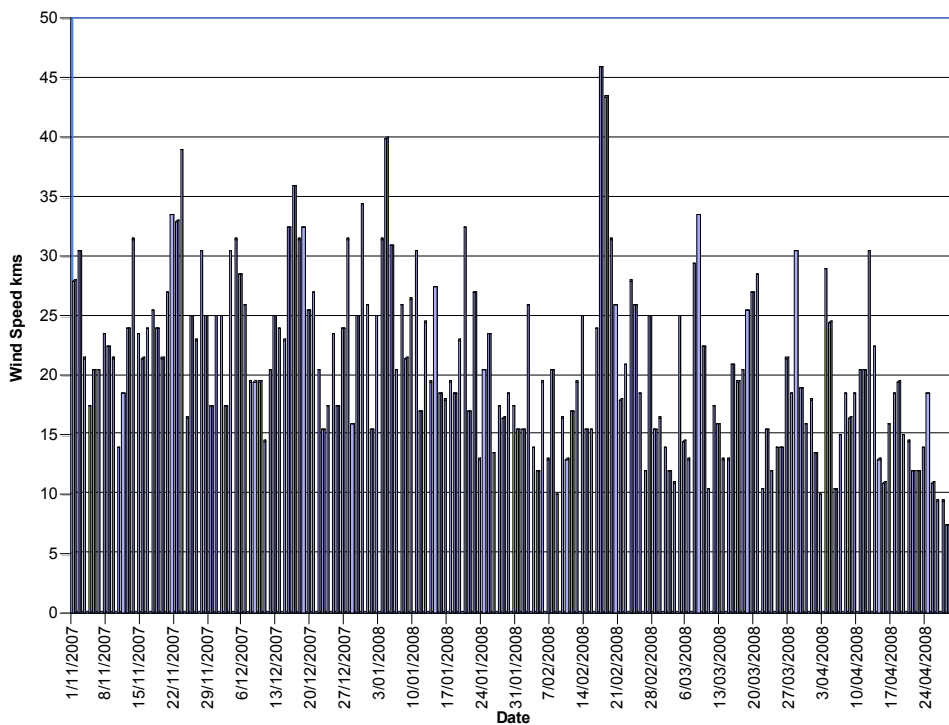
During the Pluto LNG Dredging Program, weather conditions varied but in general were average to good (wind speed of below 12 knots and Beaufort <3), with the notable exception of two periods when Cyclones Melanie and Nicholas transited the North West coast. During these periods when, sighting conditions were poor to very poor (winds greater than 20knots and Beaufort > 4). These cyclonic periods generated high winds (e.g. > 40 km/hour), increased swell and seastate, plus poor visibility that would have significantly reduced marine fauna observations. Dredging operations were suspended from 29 December until 3 January 2008 due to Cyclone Melanie and the 16 to the 18 February 2008 due to Cyclone Nicholas.

Wind strength and sea state varied considerably during the project between Beaufort 0 (e.g. winds below 1km/hour) and Beaufort 6 (e.g. winds between 40 to 50 km/hour). The mean Beaufort Sea State during the dredging period survey was approximately 3. **Figure 11** indicates the daily average wind speeds, **Figure 12** indicates the percentage of days at each wind state and **Figure 13** indicates the wave height for the Dampier region during the period of dredging operations. The average wind speed for the period of dredging 19 November 2007 to 30 April 2008 was 21 kms per hour (ranging from 7 to 46 km/hour) with 54% of days during this period with an average wind speed under 20 km/hour. The swell height was on average 0.4 m (ranging from 0.15 to 2.3 m) during the dredging period. Periods of increased swell were associated with

tropical cyclones Melanie and Nicholas. Seastate and glare from the sun were probably the most significant factor affecting sighting of marine fauna. However glare would only occupy a small percentage of the field of view from any vessel, at any one time.

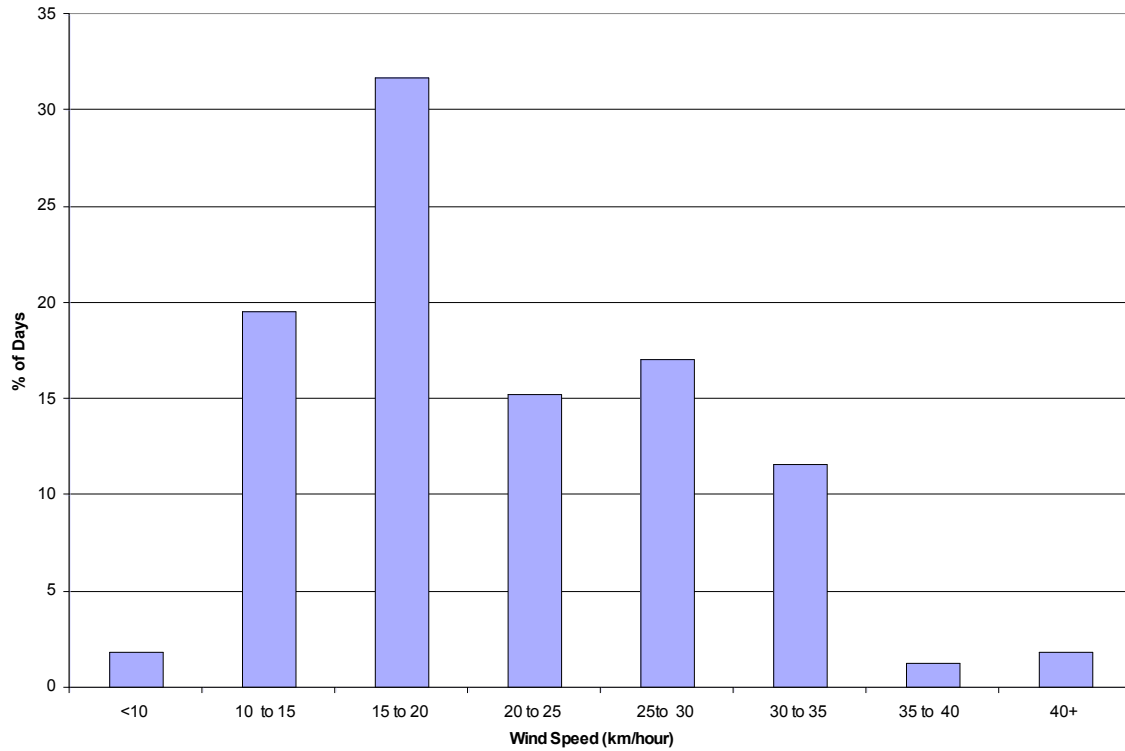
Sighting conditions above Beaufort 3 make it difficult to spot marine fauna. As conditions deteriorate beyond Beaufort 5, it is very difficult to spot any marine fauna however during these conditions dredging operations were typically suspended. **Figure 14** indicates the number of marine fauna sighting by seastate.

Figure 11 Daily average wind speed for Karratha



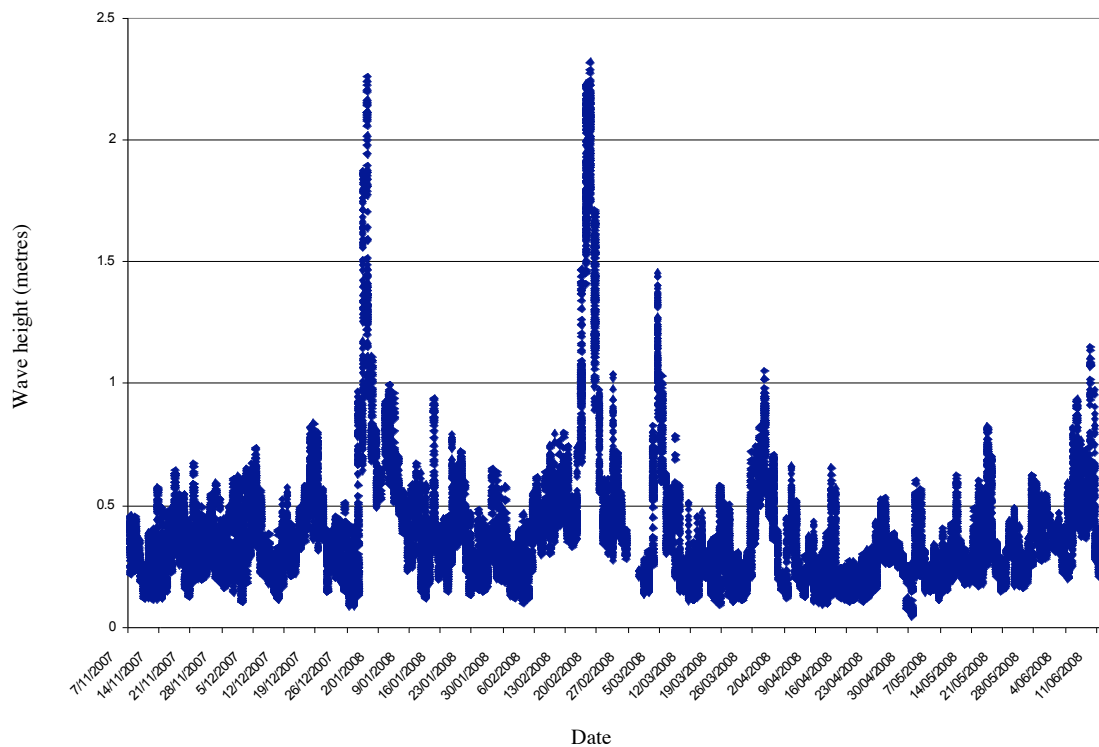
Source of data Bureau of Metrology

Figure 12 Percentage of days of wind speed (in 5km/hour categories) for Karratha



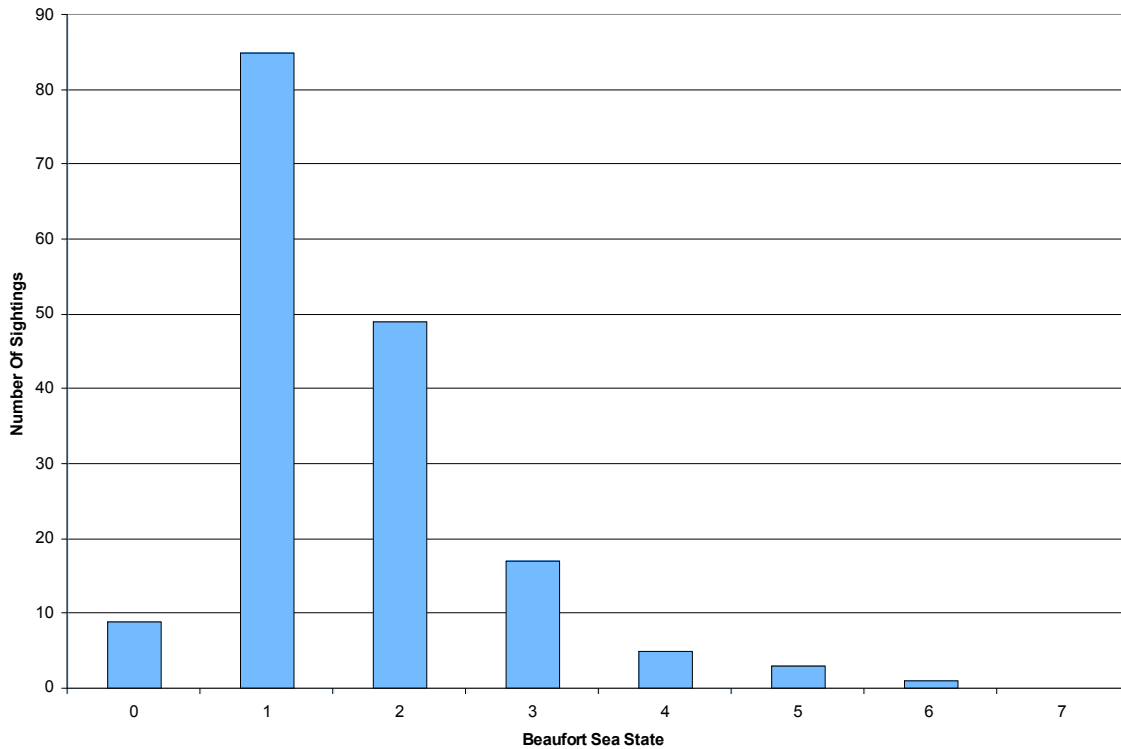
Source of data Bureau of Metrology

Figure 13 Wave Height in Mermaid Sound (Waverider Buoy -Navaid 9)



Source of data Woodside

Figure 14 Number of marine fauna sightings by sea state (Beaufort)



Sea state has the potential to bias the ‘sightability’ of marine fauna, and in particular smaller and/or non surface active species. Vessel based surveys for marine fauna have determined that the probability of sightings of marine fauna for each sea state is not consistent. Gidding and Paton (2006) determined that sightings of cetaceans declined significantly after Beaufort 3. Although the average sea state for the project was Beaufort 3, the number of marine fauna sighting reported during the project declines significantly in sea states above Beaufort 2. Therefore sea state is likely to have had an influence on the sighting rate of cetaceans during the Pluto LNG Dredging Project. Potentially sightings of marine fauna species such as turtles, which are not as obvious at the surface as many of the cetacean species, may be more adversely effected by sea state conditions.

12.2 Sighting Effort

The STMP and the DSDMP/EMP require trained marine fauna observers to undertake continual observations for marine fauna during dredging and associated activities during the Pluto LNG Development. Bridge crew and dredge operators undertook this role and were complemented by the IFO during fortnightly site visits.

The crew on the dredging vessels were all experienced seamen and had specific training from the BPM IFO relating to marine fauna observation requirements and about the marine fauna potentially found in the region. However, their role on the bridge was not as dedicated marine fauna observers. Undertaking marine fauna duties in addition to their normal role is likely to mean that their sighting efficiency is not as effective as the dedicated IFO.

The IFO was present on site on 22 days between 19 November and 30 April 2008 (i.e. 12% of days). During these IFO site visits, the IFO determined that on a number of occasions, bridge crew failed to observe marine fauna in the vicinity (e.g. within 300m) of dredging operations. This issue was brought to the attention of Woodside's Pluto LNG Project Management by the IFO and was also raised with the dredging contractor management. A significant improvement in sighting effort and record management was observed by the IFO during following site visits.

13. Comparison of Marine Fauna Sightings with Woodside's LNGV Dredging Campaign

The diversity of marine fauna species is consistent with the sighting made during the LNGV Dredging Campaign which was undertaken 2005 and 2006. However the density of sighting of dolphins was much higher during the Pluto LNG Dredging Program than reported during the LNGV Dredging Campaign (see **Appendix 1 and 6**).

This could be due to a number of possible factors.

1. Seasonal variation in the number of dolphins, however this is unlikely as the LNGV dredging program covered the same seasons as that of the Pluto dredging program;
2. An increase in the number of dolphins in Mermaid Sound;
3. Dolphins have learned to forage for food disturbed by the dredging operations and therefore spend more time in the region of dredging operations;
4. A bias in the data as a result of double counting of marine fauna due to the number of project vessels working in close proximity of each other during the project; and
5. Dredging contractors were more diligent in reporting marine fauna sightings during the Pluto Dredging Program.

Without a further detailed investigation of this issue, it will be difficult to determine the true reason for the apparent difference.

14. Turtle relocation

On the 25 January 2008, at approximately 13:00 hours, a large turtle (reported to be a Green turtle) was observed by the crew of the “Cornelis Zanen” (Trailer Suction Hopper Dredge). The turtle was observed over a period of 30 minutes at the surface approximately 200 m to the southwest of the location where the “Cornelis Zanen” was dredging in the turning basin. The turtle appeared to be unable to dive and was observed to be remaining at the surface. This turtle was observed to be slowly approaching the dredging area. At the request of the “Cornelis Zanen”, the crew of the Pluto dredging survey vessel, the “Ocean Eagle” made a closer observation of the turtle. The turtle was observed to be an adult, with no obvious signs of injury, however appeared to be unable to dive. The turtle was suspected to be suffering from floater disease.

Marine turtles can get a build up of gas in their gut or under their shell that prevents them from diving. Turtles with this ailment are known as ‘floaters’. It is believed that this is a naturally occurring event, the cause of which is not well understood and is the focus of ongoing research within Australia. It is suggested that a parasitic infection or bacteria can cause the gas build up. As the affected animals are unable to dive, it leaves them susceptible to boat strikes, predation by sharks and sunburn damage to their shells.

The crew of the “Ocean Eagle” reported the turtle’s condition to the “Cornelis Zanen”. The crew of the “Ocean Eagle” and “Cornelis Zanen” were concerned that the turtle would drift into the area where the dredge was working and would be injured by activities associated with the dredging operations or associated vessel operations.

This information was relayed through Boskalis Project Manager, Baggerman Resident Dredging Engineer to Pluto Project Environmental Officer who attempted to contact Department of Environment and Conservation personnel in relation to what action was appropriate.

Due to the event occurring on a long weekend, Woodside had difficulty in contacting Department of Environment and Conservation personnel. Due to the immediate danger to the turtle, acting in a responsible manner and with the turtle's best interests in mind, the turtle was relocated out of the dredging area. The crew of the "Ocean Eagle" relocated the turtle to a safe location to the east of the dredging area. This location is outside the region of vessel traffic from the Dampier Port and also out of the area of dredging operations.

On release the crew of the "Ocean Eagle" observed the turtle for a short period of time. The turtle still appeared to be unable to dive and remained on the surface. The turtle was not injured during the relocation activity.

Following this event, Woodside reported the relocation of the turtle to the Department of Conservation and Environment and submitted a Turtle Incident Report.

15. Other Marine Fauna Observed

A range of marine fauna species other than cetaceans, dugongs, and turtles were observed by the IFO during Pluto site visits. Other marine fauna species observed included:

- **Reptiles**
 - **Sea snakes**
 - Olive sea snake (*Aipysurus laevis*);
- **Birds**
 - Greater Frigatebird (*Fregata minor*);
 - Least Frigatebird (*Fregata ariel*);
 - Brown booby (*Sula leucogaster*)
 - Crested Tern (*Sterna bergii*);
 - Lesser crested terns (*Sterna bengalensis*),
 - Sooty Tern (*Sterna fuscata*);
 - Caspian Tern (*Hydropogone caspia*),
 - Brahminy kites (*Milvus indus*),
- **Fish**
 - Schooling bait fish (species not confirmed)

- Flying fish (most likely species *Cheilopogon pinnatibarbatus* or *Hirundichthys rondeleti*)
- Manta Ray (*Manta birostris*)
- Tiger shark (*Galeocerdo cuvier*)
- A number of unidentified shark species
- **Crustaceans**
 - Unidentified swimming crabs
- **Cnidarians**
 - Various jelly fish species (species not confirmed)

16. Dredging Contractor's Compliance with the DEWHA and WA EPA conditions of consent and Woodsides Management Plans

Part of IFO's role during the Pluto LNG Dredging Project was to monitor and assess the dredging contractor's adherence to Woodside's requirements and the conditions of consent.

There were a total of 171 sightings events of marine fauna during the Pluto LNG Dredging operating period 19 November 2007 to 30 April 2008. Of these sightings 136 pods (80%) were dolphins, 28 (16%) turtles, 1 (0.5%) dugong and a further 6 (3.5%) sightings other marine fauna including manta rays, sea snakes and sharks. No whales were sighted during the report period.

There was no evidence of direct impacts of the dredging program on marine fauna detected by the IFO during site visits. A single interruption to dredging operations due to a manta ray (which is not a prescribed species for interruptions to dredging operations) was carried out in full adherence to the agreed procedure identified in **Figure 2**. Woodside's dredging contractors (Boskalis Australia and Van Oord) were found to be diligent in their adherence to:

- the DEWHA and WA EPA requirements in relation to marine fauna interactions;
- the Pluto LNG Development Sea Turtle Management Plan; and,
- the implementation marine fauna impact mitigation components of the Pluto LNG Development Dredging and Spoil Disposal Management Plan/Environmental Management Plan.

17. References

- Gidding, L. & Paton, D. (2006) Marine Mammal Observation Survey Report for the Torosa, Snarf and Willem Seismic Surveys. Report to Woodside Energy Limited.
- Jenner, C., Jenner, M., McCabe, K. (2001). Geographical and temporal movements of Humpback Whales in Western Australian Waters. APPEA Journal 2001, pp. 749-765
- Pendoley (2005, 2006) Pendoley Reports Appendix A, Pluto LNG Development Sea Turtle Management Plan 2007. SKM/Woodside
- Pendoley, K. (2005a) Sea turtles and the environmental management of industrial activities in North West Western Australia. PhD thesis, Murdoch University.
- SKM/Woodside (2007a) Pluto Sea Turtle Management Plan. Report produced by SKM for Woodside.
- SKM/Woodside (2007b) Pluto LNG Development Dredging and spoil Disposal Management Plan/Environmental Management Plan. Report produced by SKM for Woodside.
- Woodside (2006) Woodside Pluto LNG Fact Sheet.