

MARY ROSE MC3D MARINE SEISMIC SURVEY ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan for the TGS Mary Rose MC3D marine seismic survey, which will be acquired on the Exmouth Plateau within the northern Carnarvon Basin offshore from Western Australia (WA), has been submitted to the WA Department of Mines and Petroleum (DMP), to comply with sub-regulations 11(7) and 11(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

INTRODUCTION

The geophysical company TGS proposes to undertake a multi-client, three-dimensional (3D) marine seismic survey (Mary Rose MC3D MSS), on the Exmouth Plateau within the northern Carnarvon Basin offshore from WA (**Figure 1**). The Mary Rose MC3D MSS will be comprised of approximately 9,700 square kilometres (km²) of 3D seismic acquisition in Exploration Permits WA-346-P, WA-351-P, WA-364-P, WA-365-P, WA-366-P, WA-367-P, WA-383-P, and Release Areas W10-20 and W11-13.

COORDINATES OF THE PROPOSED ACTIVITY

The survey area is comprised of two separate components—a northern component of approximately 982 km² in area, and a larger southern component of approximately 8,732 km² in area, located 55 km south of the northern component (**Figure 2**). Boundary coordinates for the northern and southern components of the survey area (see **Figure 1**) are provided in **Table 1** below.

Table 1: Mary Rose MC3D MSS survey area

| Latitude (S) | | | Longitude (E) | | |
|---------------------------|---------|---------|---------------|---------|---------|
| Degrees | Minutes | Seconds | Degrees | Minutes | Seconds |
| Northern Component | | | | | |
| 19 | 09 | 55.37 | 113 | 03 | 49.12 |
| 19 | 26 | 46.46 | 113 | 05 | 04.90 |
| 19 | 24 | 25.65 | 112 | 45 | 04.90 |
| 19 | 09 | 55.34 | 112 | 45 | 04.89 |
| 19 | 09 | 55.37 | 113 | 03 | 49.12 |
| Southern Component | | | | | |
| 19 | 54 | 55.26 | 112 | 05 | 04.88 |
| 19 | 54 | 55.30 | 112 | 12 | 32.66 |
| 19 | 54 | 32.01 | 112 | 33 | 12.50 |
| 19 | 57 | 26.57 | 113 | 05 | 04.70 |
| 20 | 13 | 59.25 | 113 | 05 | 05.11 |
| 20 | 13 | 59.50 | 113 | 07 | 37.37 |
| 20 | 25 | 04.07 | 113 | 07 | 27.84 |
| 20 | 24 | 42.01 | 113 | 33 | 13.79 |
| 20 | 30 | 13.16 | 113 | 33 | 19.27 |
| 20 | 30 | 11.92 | 113 | 11 | 44.38 |
| 20 | 40 | 05.07 | 113 | 09 | 51.50 |
| 20 | 43 | 46.77 | 113 | 05 | 22.29 |
| 20 | 52 | 03.13 | 113 | 05 | 22.09 |
| 20 | 52 | 22.65 | 112 | 35 | 04.73 |
| 20 | 21 | 26.06 | 112 | 35 | 04.69 |
| 20 | 21 | 41.12 | 112 | 05 | 04.95 |
| 19 | 54 | 55.26 | 112 | 05 | 04.88 |

Datum: GDA94

At the closest point, the southern component of the Mary Rose MC3D survey area is situated at a minimum distance of approximately 150 km to the west-northwest (WNW) of North-west (NW) Cape and the Muiron Islands, and approximately 205 km due west of the Montebello Islands. The northern component of the Mary Rose MC3D survey area is situated at a minimum distance of approximately 275 km WNW of the Montebello Islands (**Figure 1**).

The Mary Rose MC3D survey will take place on the Exmouth Plateau, which is characterised by continental slope waters ranging from 800-3,500 m. Water depths in the survey area range from approximately 1,000-1,400 m, with shallowest water depths situated in the most easterly part of the southern component of the survey area (**Figure 2**).

Figure 1: Location map – Mary Rose Multi Client 3D marine seismic survey

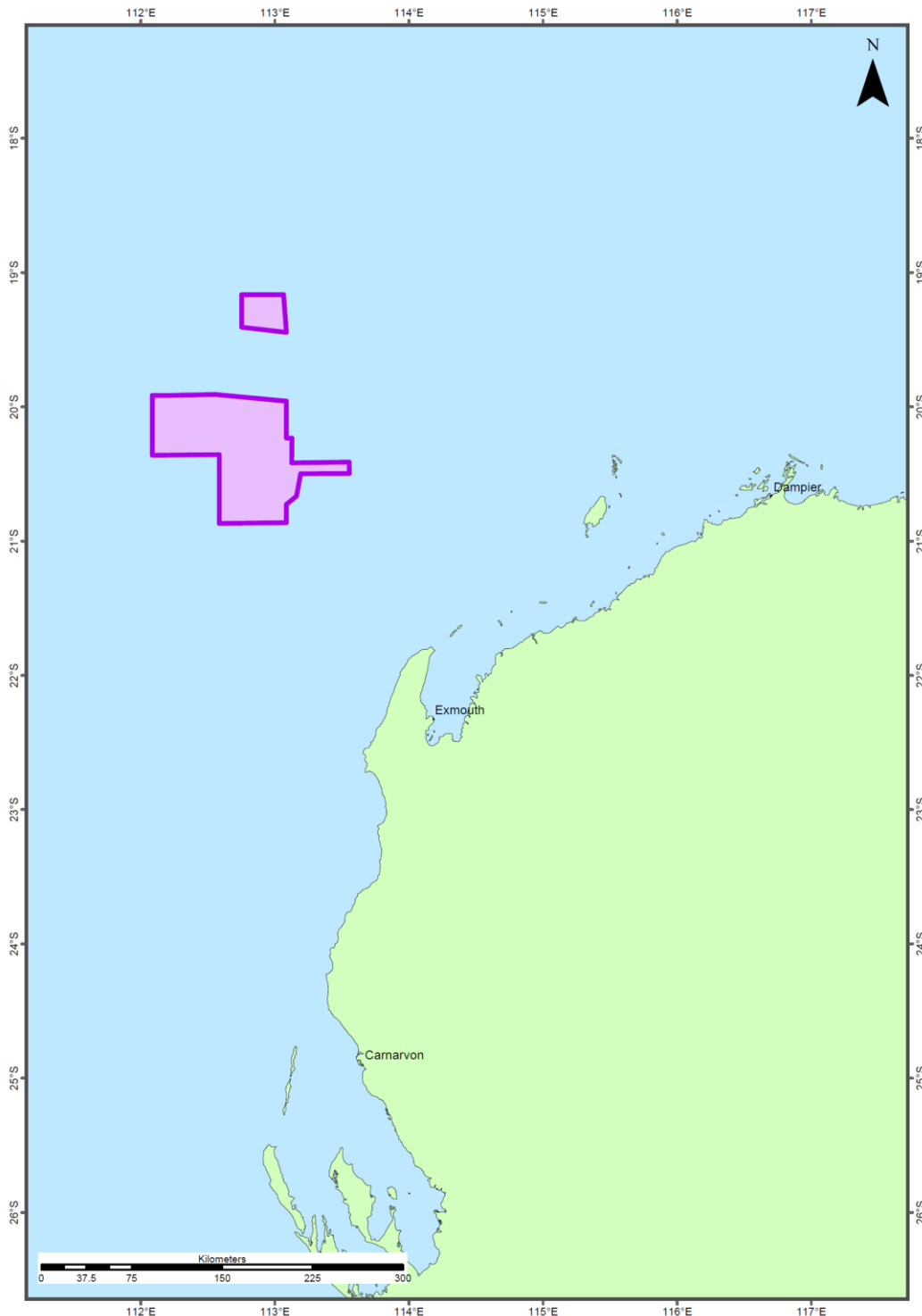
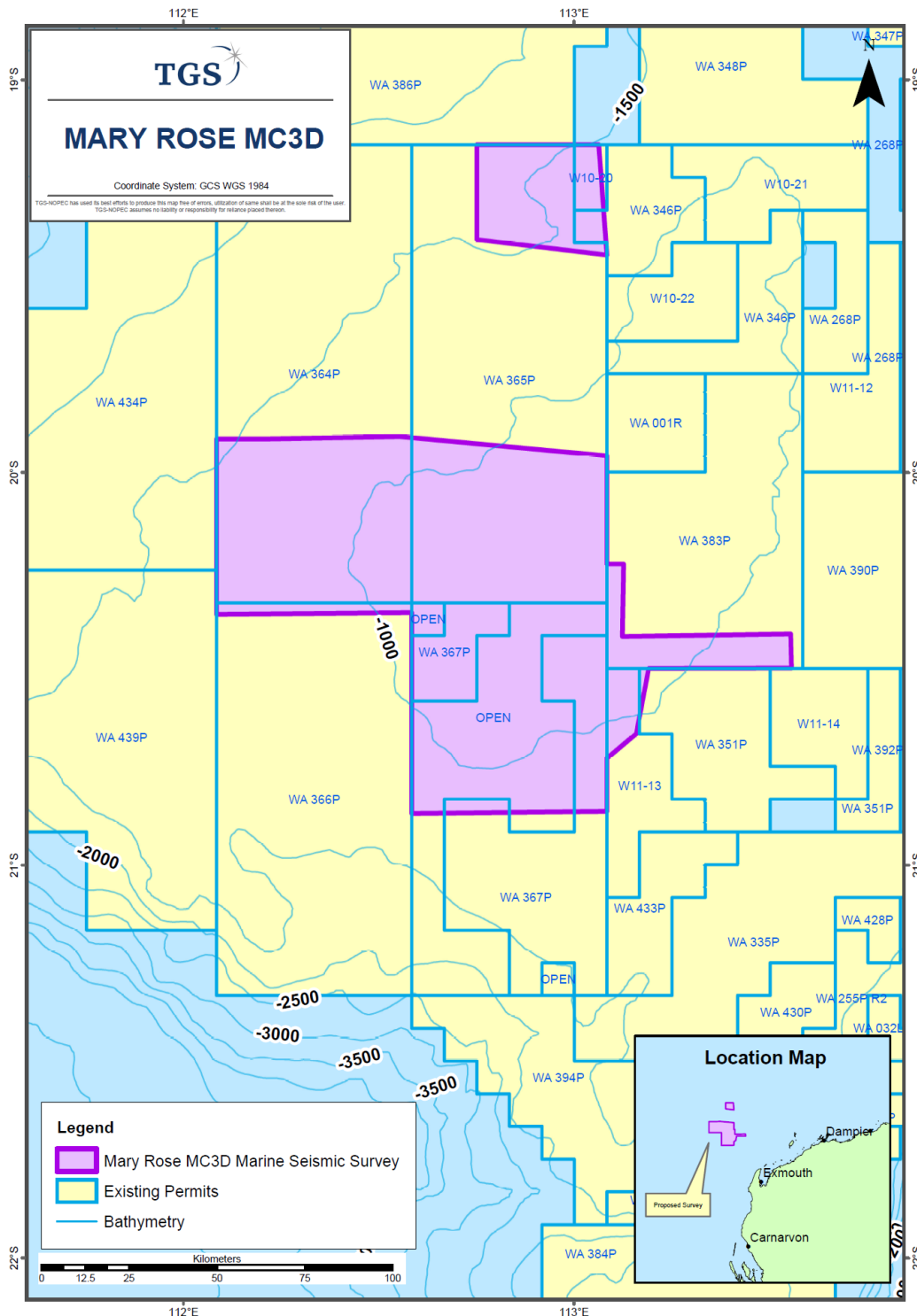


Figure 2: Northern and southern components of the survey area



DESCRIPTION OF THE PROPOSED ACTIVITY

The Mary Rose MC3D MSS is scheduled to occur in the period between the end of October 2011 and the end of March 2012 and is expected to be of approximately 160 days duration.

Timing of commencement is dependent on fair sea state conditions suitable for marine seismic acquisition, the availability of the survey vessel for conducting the survey, and granting of approvals from the appropriate government bodies.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the operational area at a speed of approximately 8-9 km/hr. As the vessel travels along the survey lines, a series of noise pulses (every 8-10 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranged along a number of hydrophone cables (streamers) towed behind the survey vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

The seismic array will comprise of a maximum of ten solid streamers, with a maximum length of 6 km. Streamer spacing will be 150 m, and line spacing will be 750 m. The source (airgun array) tow depth will be 6 m (+/- 1 m) and the streamer tow depth will be 9 m (+/- 1 m). The operating pressure for the airgun array will be approximately 2,000 psi. The airgun array will consist of two sub-arrays, each with a maximum volume of approximately 4,000 cui. These sub-arrays will be fired alternately, with a shotpoint interval of 18.75 m vertical distance, and will produce at source (i.e. within a few metres of the airguns) received sound energy levels (SELs) in the order of 265 dB re $1\mu\text{Pa}^2\cdot\text{s}$ at frequencies extending up to approximately 264 Hz.

TGS proposes to conduct the Mary Rose MC3D MSS using the purpose-built seismic survey vessel SR/V *Viking Vision*, which is owned by Eidesvik Survey AS and operated by the geophysical company CGGVeritas. The *Viking Vision* has a crew complement of 70, and the vessel has all necessary certification/registration and is fully compliant with all relevant MARPOL and SOLAS convention requirements for a vessel of this size and purpose. The *Viking Vision* has a Shipboard Oil Pollution Emergency Plan (SOPEP) in place, in accordance with Regulation 26 of Annex I of MARPOL 73/78.

The survey vessel will travel within the survey area at an average speed of 4.5 knots (approximately 8.3 km per hour).

A support vessel, the M/V *Pacific Peacock*, will accompany the seismic survey vessel to maintain a safe distance between the towed array and other vessels, and also to manage interactions with shipping and fishing activities, if required. The *Pacific Peacock*, which is owned and operated by Swire Pacific Offshore Ltd, will also re-supply the survey vessel with fuel and other logistical supplies.

During the survey, it is likely that the *Viking Vision* will be refuelled at sea using the *Pacific Peacock*, either within or immediately adjacent to the survey area. At sea refuelling of the *Viking Vision* will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow water features.

DESCRIPTION OF THE RECEIVING ENVIRONMENT

The proposed Mary Rose MC3D survey area lies entirely in Commonwealth marine waters in the Pilbara system of the North-west Marine Region (NWMR); the northern boundary of which extends west of Broome to the northern edge of Exmouth Plateau; southern boundary follows a line west of NW Cape along the southern boundary of Exmouth Plateau. The Exmouth Plateau occupies a large area of this system (approximately 5,000 km²). The surface of the plateau occurs from mid-slope depths (from about 500 m) to over 5,000 m.

Physical Environment

The Exmouth region lies in the arid zone of Australia, experiencing hot temperatures and summer droughts, and low rainfall, with terrestrial ecosystems dominated by grasslands. Intense rainfall may sometimes occur during the passage of summer tropical cyclones (generally between December and March) and thunderstorms. An average of 260 mm of rainfall is recorded each year. The summer and winter seasons fall into the periods September-March and May-July, respectively. Winters are characterized by clear skies, fine weather, predominantly strong east to southeast winds and infrequent rain. Summer winds are more variable, with strong south-westerlies dominating. Three to four cyclones per year are typical, primarily between December and March. Extreme wind conditions may be generated in the area by tropical cyclones, strong easterly pressure gradients, squalls, tornados and water spouts. Tropical cyclones generate the most significant storm conditions on the NWS.

The Pilbara system is a transitional oceanographic region between the strongly Indonesian ThroughFlow (ITF)-influenced surface waters to the north and the Leeuwin Current-influenced surface waters to the south. The source of ITF waters into this system is probably the recirculation of the South Equatorial Current into the Eastern Gyral Current, although it takes approximately one year for this cycle to transport water from Indonesia to the Pilbara coast. The along-shore pressure gradient in this system results in a predominantly southward movement of the surface water mass, which becomes the source waters of the Leeuwin Current. As with other deep areas of the marine environment, little detailed information on the physical oceanography of the Exmouth Plateau is available.

The Pilbara system is believed to have the strongest internal tides of the entire NWMR, which are thought to be an important physical driver in water depths of between 50 and 500 m depth on the shelf. The NWS and Exmouth Plateau and ramp areas are areas of known high internal wave activity. Internal tides may result in the drawing of deeper cooler waters into the photic zone, stirring up nutrients and triggering primary productivity. Generally, there is confusion about the extent of influence of internal tides in this system.

Tides in the Pilbara system range from around 4 m in the south to around 10 m at Broome. The extent of turbid waters off the coast reflects the tidal range of the system and increases from south to north to approximately the 30 m depth contour around Broome. The narrow width of the turbid zone in this system is distinctly different to the Kimberley system. Mean ocean surface temperatures in the region range from a 19-24°C in winter to 26-31°C in summer. Due to the arid climate, daytime visibility in the area is generally greater than five nautical miles. Shelf waters are usually thermally stratified with a marked change in water density at approximately 20 m.

The mean daily maximum temperature (over 30 years) recorded at the Learmonth Airfield on the eastern side of the NW Cape is 31.7°C, with the mean daily minimum temperature being 17.7°C. January is the hottest month of the year, and July is the coolest.

The Exmouth Plateau (in water depths of 800-3,500 m) is a significant geomorphic feature in the NWMR. It has a relatively uneven seafloor and may include pinnacles. The sediments are assumed to comprise nanoplankton ooze with a volcanic ash component (i.e. abyssal red clay), which are probably limited to depths below the carbonate compensation depth (~5,000m). On the northern section of the plateau is a gully margin and escarpments incised by canyon systems. They are thought to extend onto the saddle between the plateau and mainland Australia. These are recognised as a distinct feature, but little is known of their ecology and geomorphology.

Sediment from the Exmouth Plateau consists mainly of foraminiferal ooze and sand composed of 20-60% sand and 60-75% calcium carbonate grains, with the fine fraction of the surficial sediment consisting of planktonic foraminifera. Benthic mollusc fragments, pteropod shells, and planktonic and benthic foraminifera constitute the major skeletal component. The sedimentology varies in composition with water depth and reflects the abundance of biogenic components. As water depth increases, the sediment grades from calcareous oozes and sands to siliceous clays, and the high proportion of sand in the sediments suggests winnowing of finer material by bottom currents.

Biological Environment

The Exmouth Plateau, which is a sub-system of the Pilbara system of the NWMR, is recognised as a Key Ecological Feature (KEF) of the NWMR, because it is an area of enhanced biological productivity that supports a range of species. Listed migratory white-tailed tropic birds are known to forage within this area.

Little is known about productivity in the sub-system. Detrital rain is likely to play a role in nutrient cycling from pelagic to benthic environments; however other mechanisms for vertical and horizontal flow of nutrients and materials are unknown. There was some speculation about the role of Trichodesmium as a source of nitrogen in the sub-system, but there is no data to confirm its role. Hydrocarbons are known to be present in detritus and there is some thought that this may be a driver in benthic production. However, there appear to be no studies or data to support this hypothesis. Generally, it is believed that the benthic biomass in the midslope areas of this region would be much higher and more diverse than equivalent midslope areas of the east coast of Australia.

Protected Marine Fauna

A review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) database (Protected Matters search tool) held by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) was conducted for a polygon encompassing both the northern and southern components of the survey area. From the Protected Matters search, it is apparent that eight listed Threatened species may occur, or relate to, the survey area:

1. the southern giant petrel
2. the blue whale;
3. the humpback whale;
4. the loggerhead turtle;
5. the green turtle;
6. the leatherback turtle;
7. the hawksbill turtle; and
8. the flatback turtle

The survey area for the proposed Mary Rose MC3D MSS is not considered a habitat that is critical to the survival of any listed species. Similarly, there are no EPBC Act-listed threatened ecological communities (TECs) in the vicinity of the survey area.

Whales and Dolphins

The EPBC Act database lists 23 cetacean species that may occur in, and adjacent to, the survey area of the Mary Rose MC3D MSS, all of which are protected under the Act; one of which is also classified as Endangered, one as Vulnerable and six as Migratory species.

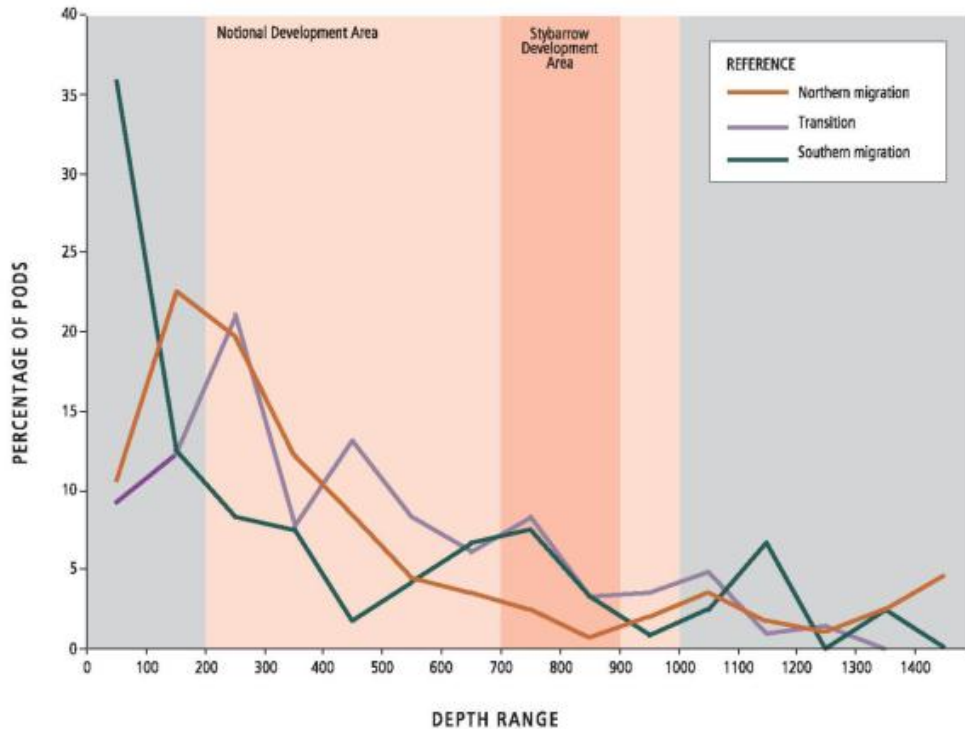
The humpback whale is the most commonly sighted whale in northern Western Australian waters. The species has been observed seasonally to complete their northbound migration in the Camden Sound area of the west Kimberley, after feeding in Antarctic waters during the summer months. It is likely that the whales follow a predictable migratory path and migrate both north and south within the continental shelf boundary (200 m bathymetry). However, on the southbound migration it is likely that most individuals, and particularly cow/calf pairs, will stay closer to the coast than the northbound migratory path.

In the NW Cape region, the migratory route (where most whales are observed) occurs in waters within 9 nm (17 km) of the coast (generally <200 m water depth). The peak of the northbound migration in the region occurs around late July, concentrated along the 200 m depth contour. The southbound return migration peaks around early September, with pods preferring to travel in shallower waters, typically between 30 and 100 m deep. Many cow/calf pairs use the Exmouth Gulf as a resting ground during the southbound migration, with many males entering the gulf intent on mating. The transition period (the crossover between the northbound and southbound migrations), occurs between early August and early September. Pod sizes during this time are the highest off the NW Cape than at any other time of the year. During the transition period, whale pods are more dispersed, occurring in shallow waters and in waters as deep as 1,100 m, covering part of the Mary Rose MC3D MSS area.

Aerial surveys have been undertaken by the Centre for Whale Research (CWR) and the Commonwealth Science and Industry Research Organisation (CSIRO) across the NW Cape region from June to December 2000 and 2001, focusing on whale sightings. During the northbound migration (June to mid-August), humpback whales are observed further offshore, however the majority of pods are observed within water depths less than 500 m (**Figure 3**). During the transition phase, the pods were dispersed over a greater range of water depths, with highest densities observed within the 200 to 300 m contours. Pods observed during the southbound migration (September to November) show a strong preference for water depths less than 200 m (**Figure 3**).

Given the proposed timing and duration of the Mary Rose MC3D it is apparent that the beginning of the survey will overlap the end of the southbound migration period for humpback whales in the region. However, it is unlikely that many whales will be encountered as most pods are found in much shallower water depths (<200 m) than the deeper, offshore waters of the survey area (1,000-1,400 m). The survey will be completed well prior to the commencement of the 2012 humpback whale migration season.

Figure 3: Percentage of humpback whales sighted at each depth during aerial surveys in 2000/01



Other rare species of whale include the blue whale, which may be present in, or adjacent to, the survey area as indicated from the EPBC Act database search. Blue whales are widely distributed throughout the world's oceans. This species has been recorded offshore in all states excluding the Northern Territory. Their migration paths are widespread and do not clearly follow coastlines or particular oceanographic features. The blue whale is rarely present in large numbers outside recognised aggregation areas. Blue whales are believed to calve in tropical waters in winter and births peak in May to June, however the exact breeding grounds of this species are unknown.

The survey area does not include any known blue whale feeding, breeding or resting areas. In the NWMR pygmy blue whales migrate along the 500 m to 1,000 m depth contour on the edge of the slope, and are likely to be feeding on ephemeral krill aggregations. The northward component of this migration takes place from May to mid-August, with a peak in July-August, and the southward component occurs from late October to November-December, with a few isolated individuals moving south in January. The migration appears to be centred on the 500 m depth contour. Consequently, there is the possibility that migrating (and possibly feeding) blue whales may be encountered in the survey area during the proposed survey period (end-October 2011 to end March 2012).

There are no known breeding, calving or feeding grounds for any listed threatened or migratory whale species within, or in the immediate vicinity of the Mary Rose MC3D survey area.

Marine Reptiles

Five marine turtle species may occur in the survey area - green turtle, leatherback turtle, hawksbill turtle, loggerhead, and flatback turtle.

Green turtles feed on macroalgae and are by far the most common turtle seen in nearshore waters. Loggerhead turtles are carnivorous, feeding mainly on molluscs and crustaceans. Hawksbill turtles feed mainly on sponges and are more often found in deeper waters of the NWMR. Green, flatback and loggerhead turtles all breed from September to March, while the hawksbill turtle breeds from July to March. The reefal habitats in the photic zone are key feeding habitats for green and hawksbill turtles.

The leatherback turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world. Nesting is mainly confined to tropical beaches although some nesting occurs on subtropical beaches. No major nesting has been recorded in Australia, although scattered isolated nesting (1-3 nests per annum) occurs in southern Queensland and the Northern Territory. It is unlikely to be encountered within the survey area and adjacent waters.

Recent Position Tracking Terminal (PTT) observations of flatback turtles have recorded their presence in the Exmouth Plateau sub-system. Overall, it is unlikely that significant numbers of marine turtles will be encountered during the seismic acquisition throughout most of the survey area, given the water depths and lack of shallow submerged features.

Seabirds

Based on the results of two survey cruises and other unpublished records, 18 species of seabird have been recorded over NWS waters. These included a number of species of petrel, shearwater, tropicbird, frigatebird, booby and tern, as well as the silver gull. Of these, eight species occur year round and the remaining 10 are seasonal visitors. From these surveys, it was noted that seabird distributions in tropical waters were generally patchy except near islands. Apache Energy commissions annual surveys of the avifauna around its operating facilities on the NWS, resulting in a significant amount of data for the area around the Barrow, Lowendal and Montebello islands groups, about 200 km to the east of the Mary Rose MC3D survey area. In 2006, 40 species of seabirds were recorded around the Lowendal Islands (89 recorded in total). Seventy species of seabird have been recorded at the Montebello Islands and 112 species at Barrow Island. In and around the Exmouth Gulf and further offshore, there is less quantitative data available.

Socio-Economic Environment

Commercial Fisheries

The region supports a valuable and diverse fishing industry, with the offshore and coastal habitats being significant at all life stages for commercial species in the region. Several commercial fisheries operate out of Exmouth and Onslow. They are managed by either the state (WA Department of Fisheries) or the Commonwealth (Australian Fisheries Management Authority, AFMA).

The main commercial fisheries potentially operating in waters covered by the Mary Rose MC3D survey area are the North West Slope Trawl fishery and the Western Deepwater Trawl fishery (both managed by AFMA).

Commercial Shipping

Although there are no defined shipping lanes in the NW Cape region, clear shipping routes emerge when Australian Ship Reporting System (AUSREP) data is analysed. Under the *Navigation Act 1912* (Commonwealth), all vessels operating in Australian waters are required to report their location on a daily basis to the Rescue Coordination Centre (RCC Australia). AUSREP is an integral part of the Maritime Search and Rescue (SAR) system in Australia, and is operated by the AMSA through the RCC Australia.

Data obtained from the Australian Marine Spatial Information System (AMSIS) for 2006-2007 indicates a clear north-south shipping route running parallel to the Cape Range Peninsula and then heading north from west of the NW Cape—this is the shipping route between the Australian west coast and Lombok Strait. In 1999-2000, about 657 vessels used this route. Another shipping route parallels the coast between the NW Cape and the port of Dampier, with significantly fewer vessels using this on an annual basis (less than 150 annually). The offshore shipping route is likely to overlap with the survey area to some degree.

Oil and Gas Industry

An emerging industry in the NW Cape region is the oil and gas industry. The Exmouth Sub-basin and surrounding basins contain known or highly prospective hydrocarbon fields that have been subject to exploration activity since the early 1950s. Australia's first flowing well was drilled in this basin, with numerous wells drilled onshore in and around the now Cape Range National Park. Other petroleum field developments that operate in, or are planned for development in the Exmouth Sub-basin include Woodside's Enfield and Vincent Projects, BHP Billiton Petroleum's (BHPP) Pyrenees and Stybarrow Projects, and Apache's Van Gogh Project. As part of the consultation programs regarding the floating production storage and offtake (FPSO) oil projects either currently planned or under development, the local community and relevant interest groups are familiar with the nature of these developments and potential impacts.

All of the petroleum projects currently in production, or under development, are located well to the south of the Mary Rose MC3D survey area.

Marine Protected Areas

The nearest Commonwealth marine reserve to the Mary Rose MC3D survey area is the Commonwealth waters component of Ningaloo Marine Park, which is located approximately 130 km south-east of the southern boundary of the survey area (southern component). At the closest point, the boundary of the State waters component of Ningaloo Marine Park is located approximately 140 km south-east of the survey area. The Muiron Islands Marine Management Area, which is situated to the north-east and immediately adjacent to Ningaloo Marine Park, is located approximately 155 km south-east of the survey area.

The southern part of the southern component of the survey area lies within the northern most extent of the proposed Gascoyne Commonwealth marine reserve.

Defence Activities

Release Area W11-13 (part of which is covered by the southern component of the survey area) overlaps Military Exercise Area (MEA) R862 and Learmonth air-to-air weapons range. This area is approved for live weapons firing, including high explosive weapons. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level.

Cultural Heritage Values

There are no known indigenous cultural heritage values or issues for the waters and seabed within and immediately adjacent to the Mary Rose MC3D MSS area. Similarly, there are no current or pending Native Title Determinations for the waters and seabed within and immediately adjacent to the survey area.

Records maintained by the WA Maritime Museum Shipwreck Database and the Australian National Shipwreck Database indicate that there are several ships wrecked close to the coast around the NW Cape, and 28 wrecks are recorded in the Exmouth Gulf. There are no recorded historic shipwreck sites within or immediately adjacent to the Mary Rose MC3D survey area.

MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

All aspects of the Mary Rose MC3D MSS have been subjected to risk analysis, which has been used to evaluate the potential environmental risks and effects, and characterize risk likelihood and severity. **Table 2** summarises the risk analysis for the key aspects of the survey.

Given the management requirements that will be implemented for all environmental aspects of the survey, the risk of significant adverse environmental effects from the proposed Mary Rose MC3D MSS has been assessed as low for all aspects, apart from acoustic disturbance to cetaceans, interference with commercial fishing activities, and fuel and oil spills, which have been assessed as medium. The implementation of specific whale monitoring and encounter procedures will be used to minimise the potential for any adverse effects to whales. These procedures comply fully with the Australian Commonwealth Government Guidelines: *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (September 2008).

Two dedicated, expert Marine Mammal Observers (MMOs) will be aboard the survey vessel for duration of the Mary Rose MC3D survey. The key role of the MMOs will be to visually monitor the waters around the survey vessel for the presence of cetaceans during daylight hours. The MMOs will be responsible for recording any cetacean sightings during the survey on the appropriate sightings forms, using the 'Cetacean Sightings Application' software provided by the Australian Marine Mammal Centre (AMMC) at the Australian Antarctic Division. Sighting records will be sent to the TGS Environmental Adviser by the Client Site Representative, and also reported to the AMMC. The MMOs will also be responsible for ensuring that the interaction procedures are implemented and followed correctly during survey activities.

The survey will be conducted in water depths of 1,000-1,400 m away from any shallow water habitat areas that may be important for turtle feeding. The survey area is located at least 150 km away from any beaches and adjacent shallow waters that are important for turtle nesting, hatching and breeding. The survey area is located at least 150 km from any locations important for seabird breeding.

The survey is unlikely to have any significant effects on benthic communities due to the water depths across the operational area (1,000-1,400 m). Anchoring of the survey or support vessel will only occur in emergency circumstances and both vessels are fitted with highly sophisticated position fixing equipment.

At sea refuelling of the *Viking Vision* will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow water features.

MANAGEMENT APPROACH

The environmental management approaches relevant to key aspects of the Mary Rose MC3D MSS are summarised in **Table 2**. The survey will be conducted in accordance with all legislative and regulatory requirements, to the satisfaction of the Designated Authority (DMP). The design and execution of the proposed Mary Rose MC3D MSS will be conducted under the framework of the TGS Health, Safety, Environment (HSE) Management System and the survey vessel operator HSE Management System. The program will be supported by Emergency Response Plans (ERPs), a Project Plan (that incorporates HSE elements), and an HSE-MS Bridging Matrix between TGS and the survey vessel operator's HSE management systems. To ensure TGS's environmental objectives and management standards are achieved, the seismic contractor will be required to comply with all relevant requirements of TGS's HSE systems/policies and standards.

TGS and its contractor will apply a tiered approach to optimising the environmental performance of the project and ensuring that TGS's environmental objectives and management standards are achieved. The approach involves identification of local and regional environmental sensitivities, prioritisation of risks, determination of appropriate practices and procedures to reduce those risks, and clear designation of roles and responsibilities for implementation.

Table 2: Summary of environmental risks and management approach for key aspects of the Mary Rose MC3D MSS

| Hazard / Incident | Potential Hazard Consequence | Risk and Management Approach |
|--|--|---|
| Disturbance to marine fauna | Cetaceans - behavioural reactions (avoidance, diving, increased dive times) Disturbance to marine turtles Disturbance to fish communities Disturbance to seabirds | <p>Low (fish, turtles), medium (cetaceans) risk.</p> <ul style="list-style-type: none"> ➤ Interaction procedures in place and adhered to: <ul style="list-style-type: none"> • Observation zone of 3 km radius, low power zone of 2 km radius, shut-down zone of 500 m radius • 'Soft start' procedures • Use of two dedicated marine Mammal Observers (MMOs) for the entire duration of the survey • Sighting reports completed and returned to TGS and to the Australian Marine Mammal Centre at the Australian Antarctic Division, using the 'Cetacean Sightings Application' software ➤ Application of vessel-whale interaction procedures for non-acoustic energy source operations ➤ Survey will be conducted in water depths of 1,000-1,400 m away from any shallow water habitat areas important for turtle feeding ➤ Survey area is located at least 150 km away from any beaches and adjacent shallow waters important for turtle nesting, hatching and breeding ➤ Survey area is located at least 150 km from any locations important for seabird breeding ➤ Lighting minimum required for navigation and safety requirements ➤ The survey will not be operating over critical habitat for feeding, spawning, breeding or migrating fish populations ➤ 'Soft start' procedures at the start of each line |
| Disturbance to benthic habitats | Small localised disturbance to epibiota in event of loss of equipment | <p>Low risk.</p> <ul style="list-style-type: none"> ➤ The survey will be conducted in water depths of 1,000-1,400 m away from any shallow water areas ➤ No anchoring of the either the survey vessel or support vessel will take place during the survey unless in an emergency ➤ All reasonable efforts taken to retrieve lost equipment ➤ Recording and reporting of all items lost overboard |
| Interference with commercial fisheries | Interference to commercial fishing vessels operating within or near the survey area and surrounding waters Potential direct and indirect noise impacts on target species Restriction of access to fishing grounds, loss or damage to fishing | <p>Medium risk.</p> <ul style="list-style-type: none"> ➤ Consultation with fisheries management agencies, fishing industry bodies and individual companies prior to survey commencing, to inform them about the location of the survey area and timing of operations, and to ascertain if proposed operations overlaps any key fishing grounds ➤ Use of a support vessel to manage vessel interactions ➤ Establishment of an exclusion zone (Safe Navigation Area) around the survey |

| Hazard / Incident | Potential Hazard Consequence | Risk and Management Approach |
|---------------------------------------|---|--|
| | gear | vessel and towed array <ul style="list-style-type: none"> ➤ Compliance with AMSA administered marine safety regulations and marine notification requirements ➤ Fishermen and other mariners alerted of vessels presence and extent of towed array ➤ Display of appropriate navigational beacons and lights, radar watch ➤ Recording of sightings of fishing vessels ➤ Consultation with fishermen at sea, if necessary |
| Interference with shipping activities | Interference to commercial shipping operating within or near the survey area and surrounding waters | Low risk. <ul style="list-style-type: none"> ➤ Use of a support vessel to manage vessel interactions ➤ Compliance with AMSA administered marine safety regulations and marine notification requirements ➤ Mariners alerted of presence of survey vessel and extent of towed array ➤ Establishment of an exclusion zone (Safe Navigation Area) around the survey vessel and towed array ➤ Issuance of Notice to Mariners ➤ Display of appropriate navigational beacons and lights, radar watch ➤ Radio warnings to shipping, as required |
| Waste disposal | Localised temporary decrease in ambient water quality from discharge of sewage, grey water, putrescible waste, chemicals and solid and hazardous wastes | Low risk. <ul style="list-style-type: none"> ➤ Survey and support vessels will have certified approved sewage treatment plants, under <i>Marine Orders, Part 96 (Marine Pollution Prevention – Sewage)</i> ➤ Treat in accordance with MARPOL 73/78 Annex IV prior to discharge ➤ No discharge of treated sewage within 4 nm of land ➤ Sewage treatment systems operational and includes maceration and disinfection; and relevant discharge requirements are adhered to ➤ Quantities of treated sewage and putrescible wastes discharged overboard are recorded on the vessel's <i>Waste Log Forms</i> ➤ Procedures comply with requirements of <i>Marine Orders, Part 95 (Marine Pollution Prevention – Garbage)</i> and <i>Marine Orders, Part 94 (Marine Pollution Prevention - Harmful Substances in Packaged Forms)</i> ➤ Correct segregation of solid and hazardous wastes ➤ All waste receptacles aboard the survey and support vessels will be covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard ➤ Vessel <i>Waste Log Form</i> details quantities of wastes transported ashore |

| Hazard / Incident | Potential Hazard Consequence | Risk and Management Approach |
|------------------------------|---|--|
| Fuel and oil spills | Acute toxicity effects on marine fauna such as marine turtles, fishes and seabirds | <p>Medium risk.</p> <ul style="list-style-type: none"> ➤ Seismic and support vessel will maintain a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with requirements of MARPOL 73/78 Annex I ➤ All vessel operations will be conducted in compliance with the Australian Offshore Support Vessel Code of Safe Working Practice (e.g. radar monitoring, vessel communications etc.) ➤ MARPOL Oil Record Book kept up to date ➤ Fuel spill contingency procedures are in place and operational ➤ At sea refuelling will not be undertaken within a distance of 25 km from any emergent land or shallow water features ➤ At sea refuelling during daylight hours only ➤ Designated containment areas aboard the vessel for storage of oils and greases ➤ Sufficient spill response equipment on board to respond to foreseeable spill events ➤ All deck spills aboard the survey and support vessels will be cleaned-up immediately, using appropriate equipment from the onboard spill response kits (e.g. absorbent materials etc.) to minimise any likelihood of discharge of spilt hydrocarbons or chemicals to the sea ➤ Appropriate actions are taken to minimise pollution ➤ Any significant spills (>80 L) are reported to the relevant sections within WA DMP |
| Introduction of marine pests | Introduction and establishment of non-indigenous (i.e. foreign) marine species with consequent impacts on benthic communities, fisheries etc. | <p>Low risk.</p> <ul style="list-style-type: none"> ➤ Procedures comply with AQIS <i>Australian Ballast Water Management Requirements</i> ➤ AQIS ballast water log is kept up to date ➤ Procedures comply with the <i>National Biofouling Management Guidance for the Petroleum Production and Exploration Industry</i> ➤ Both survey and support vessel have all AQIS clearances to operate unrestricted in Australian waters |

CONSULTATIONS

Consultation regarding the proposed Mary Rose MC3D MSS has been undertaken with stakeholder groups, including a number within the commercial fishing industry, in Western Australia. The following organisations have been contacted and informed of the proposed operations:

- A Raptis and Sons
- Austral Fisheries Pty Ltd
- Australian Fisheries Management Authority (AFMA)
- Australian Hydrographic Office (AHO)
- Australian Maritime Safety Authority (AMSA)
- Border Protection Command (BPC)
- Centre for Whale Research (CWR)
- Coastwatch
- Commonwealth Fisheries Association (CFA)
- Department of Defence
- Kimberley Professional Fishermen's Association (KPFA)
- Northern Fishing Companies Association (NFCA)
- Shark Bay Seafoods
- TunaWest
- Western Australian Department of Fisheries (DoF)
- Western Australian Fishing Industry Council (WAFIC)
- Western Australian Northern Trawl Owners Association (WANTOA)
- WestMore Seafoods

Consultation with all of the stakeholders listed above, plus any others identified during the consultation process, will continue during and after the survey, if necessary.

To date (as of 31st October 2011) TGS has only received responses from the following four stakeholders contacted in relation to the Mary Rose MC3D survey:

- AFMA
- AHO
- DoF (Perth)
- MG Kailis

TGS confirms that, at this point in time, there are no outstanding issues to be addressed with stakeholders concerning the Mary Rose MC3D survey.

FURTHER DETAILS

For further information about the proposed TGS Mary Rose MC3D MSS on the Exmouth Plateau within the northern Carnarvon Basin offshore from Western Australia, please contact:

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