

EXECUTIVE SUMMARY

1 INTRODUCTION

This Executive Summary summarises the Draft Environmental Impact Assessment (EIA) Report and Environmental Management Plan (EMP) prepared as part of the EIA process that is being undertaken for a proposed three-dimensional (3D) seismic survey in Petroleum Exploration Licence 90 (PEL 90), Orange Basin, off the coast of southern Namibia. PEL 90 governs Block 2813B, which is located in the deepwater Orange Basin off the coast of southern Namibia (see Figure 1). PEL 90 covers an area of approximately 5 433 km² and is located between 200 km and 250 km offshore in water depths ranging from 2 300 m to 3 300 m.

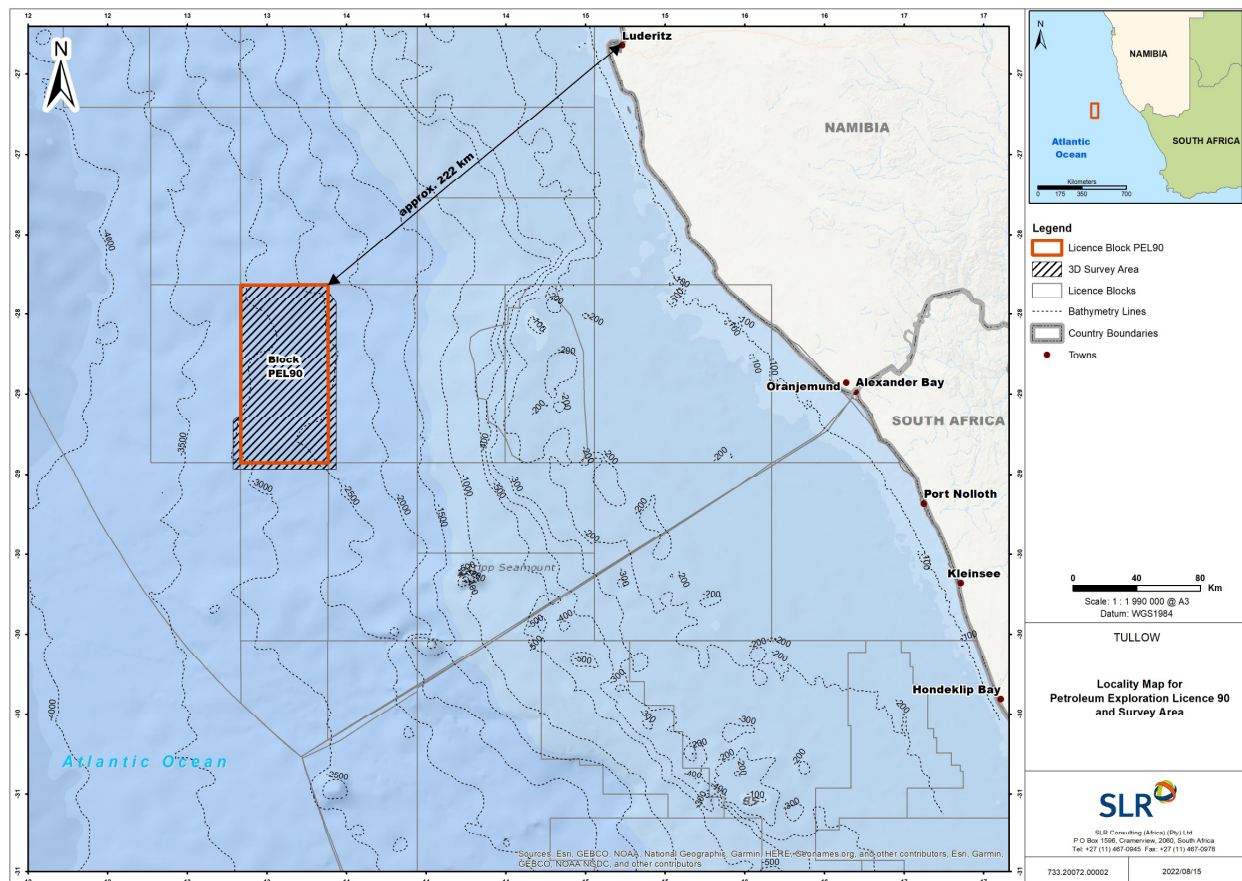


Figure 1: Locality of PEL 90 and proposed survey area off the coast of southern Namibia

1.1 PROJECT BACKGROUND

In January 2021, Tullow Namibia Limited (“Tullow”) applied for an Environmental Clearance Certificate (ECC) to undertake the 3D seismic survey in PEL 90 to acquire data on the subsea geological formations. Subsequent to the application for the ECC and the commencement of the EIA process, on 17 January 2022, Tullow assigned its interest in the block to Harmattan Energy Limited (Harmattan) and Trago Energy (Pty) Ltd (Trago). Harmattan and Trago now hold 37.06% and 52.94% of the participating interest in PEL 90, respectively, with the National Petroleum Corporation of Namibia (NAMCOR) holding the remaining 10%.

Harmattan has taken over as the applicant for the ECC for the proposed 3D seismic survey in PEL 90. SLR Environmental Consulting (Namibia) (Pty) Ltd (SLR) was appointed as the Independent Environmental Assessment Practitioner to undertake the EIA process for the proposed project.

1.2 OPPORTUNITY TO COMMENT

Interested and Affected Parties (I&APs) are asked to comment on the Draft EIA Report and EMP, which is being distributed for a 30-day comment period from **29 August to 28 September 2022**. For comments to be included in the Final EIA Report and EMP, they should reach SLR by **no later than 28 September 2022**.

SEND COMMENTS TO:

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Comments received on the draft report will be documented in a Comments and Responses Report. The draft report will be updated into a Final EIA Report and EMP, which will annex the Comments and Responses Report. The final report will be submitted to the Ministry of Mines and Energy (MME): Directorate of Petroleum Affairs for consideration and review. In terms of Section 32 of the Environmental Management Act, 2007 (No. 7 of 2007), MME is then required to make a recommendation on the acceptance or rejection of the report to Ministry of Environment, Forestry and Tourism (MEFT): Directorate of Environmental Affairs (DEA), who will make the final decision on the ECC application.

2 EIA PROCESS

The purpose of the EIA is to identify, assess and report on potential impacts the proposed project may have on the receiving environment. The EIA describes and analysis what the consequences of the project choices will be in terms of impacts on the natural and socio-economic environment and applying the Mitigation Hierarchy, identifies how such impacts can, as far as possible, be avoided, be enhanced or mitigated and controlled.

The EIA process consists of two phases (namely Scoping and Impact Assessment) and a series of steps to ensure compliance with the EIA Regulations 2012 (see Figure 2).

2.1 SCOPING PHASE

The purpose of the Scoping Phase was to communicate the scope of the proposed project to I&APs, identify project alternatives, highlight potential environmental and social impacts, and develop the terms of reference for specialist studies to quantify the impacts and recommend control measures. The Scoping Phase involved a process of:

- Notifying I&APs of the proposed project and the steps in the EIA process;
- Creating opportunities for I&APs to interact with the EIA project team; and
- Providing adequate information for I&APs to comment and identify environmental and social issues of concern.
 - The Draft Scoping Report (DSR) was distributed for a 30-day review and comment period from 3 November to 3 December 2021. Copies of the DSR were made available on the SLR website for

download, as well as libraries in Walvis Bay and Lüderitz. All written submissions received during the DSR review and comment period (four in total) were collated, and responded to, in a Comments and Responses Report.

- Telephonic and WhatsApp discussions were held with key stakeholders (including Ministry of Fisheries and Marine Resources, Large Pelagic and Hake Longlining Association and Lüderitz Mariculture / Tuna & JV) to inform them of the proposed project and DSR comment period.

At the end of the DSR review and comment period, a Final Scoping Report (FSR) was prepared in compliance with Section 8 of the EIA Regulations 2012. The FSR set out the key issues that required further investigation and the terms of reference for the specialist studies. **The FSR was accepted by MEFT on 5 April 2022**, which confirmed that the EIA can continue with the detailed assessment as per Regulation 14 and 25 of the EIA Regulations 2012 and that the key environmental impacts, as outlined in Chapter 9 of the FSR, must be considered and assessed.

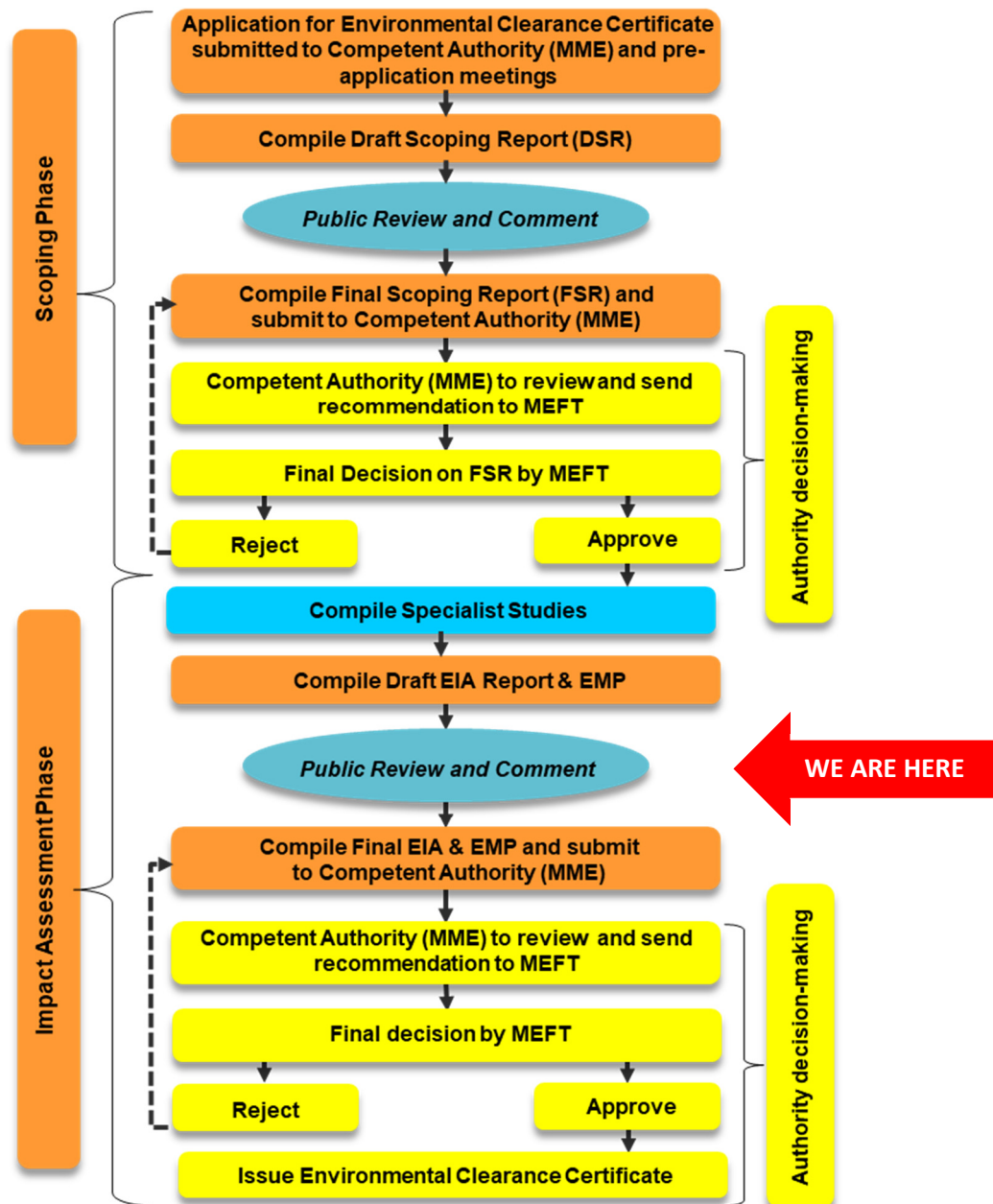


Figure 2 Outline of detailed steps in the EIA Process

2.2 IMPACT ASSESSMENT PHASE

The three specialist studies undertaken to respond to the key issues of concern, were the: (1) Underwater Noise Modelling; (2) Biodiversity and Ecosystem Services Assessment; and (3) Commercial Fisheries Impact Assessment.

The Draft EIA Report and EMP has been prepared in compliance with Section 15(2) of the EIA Regulations 2012. The specialist findings on the impact assessment, recommended mitigation and enhancement measures, as well as other relevant information, have been integrated into this report and provides further opportunity for I&APs to comment on the proposed project and draft findings of the Impact Assessment.

The following steps are envisaged for the remainder of the Impact Assessment Phase:

- After closure of the comment period on the Draft EIA Report and EMP, the draft report will be updated into a Final EIA Report and EMP. All comments received will be incorporated and responded to in a Comments and Responses Report, which will be appended to the final report.
- The Final EIA Report and EMP will be submitted to MME for consideration and review. MME will then forward it with a recommendation to MEFT for a decision on the ECC application.
- The decision taken by MEFT will be distributed to all I&APs registered on the project database.

The full stakeholder engagement process undertaken is detailed in Chapter 4 of the main report.

3 PROPOSED PROJECT DESCRIPTION

3.1 PRINCIPLES OF SEISMIC SURVEYS

Marine seismic surveys are a reliable form and an essential part of initial exploration for hydrocarbons. They provide information on the depth, position and shape of underground geological formations. Seismic surveys are temporary and transitory and the most cost-effective and technically capable means to understanding where recoverable hydrocarbon resources likely exist.

The principles of marine seismic acquisition are illustrated in Figure 3. During seismic surveys, seismic vessels travel along specific pre-plotted survey lines within the survey area that have been carefully chosen to most efficiently predicted hydrocarbon bearing geological structures. Compressed air is released from a sound source into the water to create short duration sound waves that reflect off subsurface geological (rock) layers. Reflected energy is detected by hydrophones (sensors) in each of the streamers towed behind the seismic vessel. The data is transmitted from the streamers to a computer on board the seismic vessel, where the data is quality controlled and undergoes initial processing. The data is then sent to a processing centre to undergo further analysis and interpretation to produce seismic images of the subsurface.

Marine seismic survey operations are normally conducted at a speed of between 4 and 5 knots, with the sound source typically activated at 10-15 second intervals.

A seismic acquisition campaign can be carried out in two or three dimensions (2D or 3D). For this project, Harmattan is proposing to undertake a 3D seismic survey, as the regional 2D acquisition has previously been undertaken in this area.

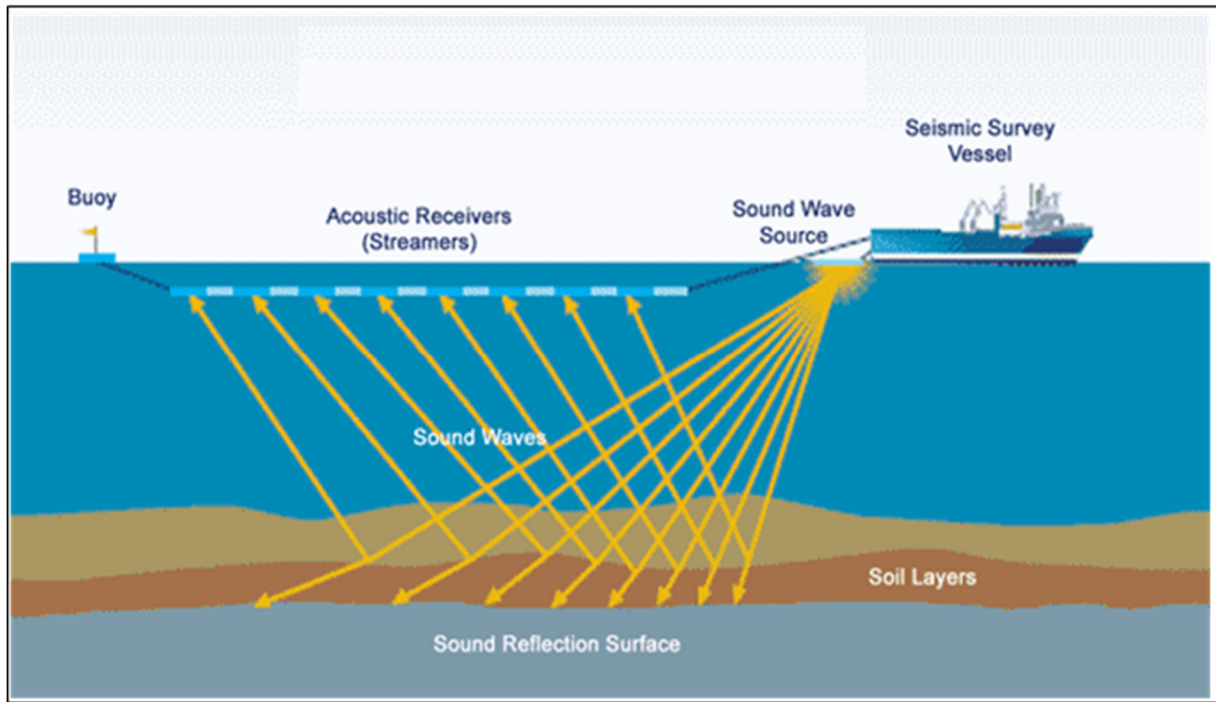


Figure 3: The Process of Collecting Offshore Seismic Data

Source: <https://www.noia.org/>

3.2 PROJECT SCOPE AND MAIN PROJECT COMPONENTS FOR SEISMIC SURVEYING

Harmattan is proposing to survey the full block area (i.e. approximately 5 433 km²), as well as possibly an area 4 km to the south, east and west of the block (i.e. approximately 742 km²), resulting in a total area of approximately 6 175 km². Depending upon good weather, the duration of the survey will be in the order of 2.5 to 3 months. Harmattan proposes to commence with the 3D seismic survey in an Austral summer survey window within the ECC validity period.

The main project components of the proposed seismic survey include the following:

- Seismic survey vessel: There will be a single survey vessel equipped with seismic sources and streamers.
- Support and escort vessels: Two additional vessels will be commissioned for the survey; one support vessel and one escort vessel (or "guard" vessel). The support vessel will be required to perform logistics support (including crew changes, supply of equipment, fuel, food and water) to the survey vessel. The escort vessel will assist in monitoring for and alerting other vessels (e.g. fishing, transport, etc.) about the survey and the lack of manoeuvrability of the survey vessel.
- Helicopter: Helicopters may also be used to transfer personnel to and from the survey vessel and Lüderitz or a suitable location nearby.
- Onshore logistics base: The onshore logistics base will be located in either the Port of Lüderitz or the Port of Walvis Bay. The preferred alternative is Lüderitz due to its proximity to PEL 90.

4 SUMMARY OF BASELINE INFORMATION

This section provides a brief description of the attributes of the receiving environment of the licence area and the central to southern Namibian offshore regional area (refer to Section 7 of the main report for further detail).

Receptor/ Variable	Description Summary
1. Bio-physical considerations	
Climate	- The climate of the Namibian coastline is classified as hyper-arid with typically low, unpredictable winter rains and strong predominantly south-easterly winds. - The strongest winds occur in summer (November to April) with virtually all coming from the south, south-east and south-south-east. Southerly winds occur over 40% of the time, averaging 20 – 30 kts and reaching speeds in excess of 60 kts. - Winter (May to October) remains dominated by southerly to south-easterly winds. There are more calms in winter, occurring about 3% of the time, and wind speeds generally do not reach the maximum speeds of summer.
Bathymetry and Sediments	- PEL 90 is located beyond the continental shelf in water depths ranging from ~2 300 m to 3 300 m. - Tripp Seamount is a geological feature situated approximately 230 km offshore and rises from the seabed at approximately 1 000 m to a depth of 150 m. This seamount is an important feature because it attracts an abundance of marine life and is a productive fishing ground. Since the seamount is located approximately 100 km to the south-east of PEL 90, effects from the seismic survey are not expected. This will, however, be confirmed in the Impact Assessment phase. - Sediments in the vicinity of PEL 90 is dominated by muds.
Benguela Current and Upwelling	- The Namibian coastline is strongly influenced by the Benguela Current system, which is characterised by coastal upwelling (see Figure 4) and is an important centre of plankton production, which supports a global reservoir of biodiversity and biomass of sea life. - The Lüderitz upwelling cell is the most intense upwelling cell in the system, with the seaward extent reaching nearly 300 km. - The Lüderitz Upwelling Cell / Orange River Cone (LUCORC) area forms a major environmental barrier between the northern and southern Benguela sub-systems. As PEL 90 is located well offshore of the upwelling cells, nutrient concentrations are expected to be low.
Marine Fauna	- The benthic habitat type in PEL 90 is considered 'Least Threatened' (Figure 5). - Substantial shelf areas in the productive Benguela region could potentially be capable of supporting rich, cold water, benthic, filter-feeding communities. Such communities would also be expected with topographic features such Tripp Seamount (100 km to the south-east of PEL 90). - The preferred spawning grounds of numerous commercially exploited fish species are located inshore and to the north and south of PEL 90 (Figure 6). - Plankton, zooplankton and ichthyoplankton abundances in PEL 90 are expected to be low. - As the survey area is located approximately 190 km offshore at its closest point, encounters with pelagic fish and seabirds are most likely. - Five species of turtles occur off Namibia. However, only the leatherback and loggerhead turtles are likely to be encountered within PEL 90, but their abundance is expected to be low. - Thirty-three species of whales and dolphins are known or likely to occur in Namibian waters and thus could be encountered in PEL 90 - The closest fur seal colonies to PEL 90 are at Van Reenen Bay and Baker's Bay approximately 190 km inshore and to the east of the survey area.
Conservation and Protected Areas	- The Namibian Islands' Marine Protected Area (NIMPA) lies inshore of PEL 90, with the closest point being over 170 km away from the survey area. - All three of the designated coastal Ramsar sites in Namibia (including Orange River Mouth, Sandwich Harbour, and Walvis Bay Wetland) fall within the broader project area. However, do not overlap with the survey area (all between 285 km and 560 km from of PEL 90). - PEL 90 lies well offshore from all onshore Important Bird Areas (IBA), but overlaps with the proposed Atlantic Southeast 21 marine IBA, which specifically targets the protection of Atlantic Yellow-nosed Albatross, Black-browed Albatross and White-chinned Petrels.

Receptor/ Variable	Description Summary
	PEL 90 does not overlap with any Ecologically or Biologically Significant Areas (EBSA). However, a vessel route between the PEL 90 and Lüderitz or Walvis Bay would pass through the Benguela Upwelling System EBSA and possibly the Namibian Islands EBSA (for Lüderitz alternative only).
2. Socio-economic considerations	
Commercial Fisheries	Fishing plays a significant role in providing livelihoods and income for communities living in and around Lüderitz and Walvis Bay. Only one fishery overlaps with PEL 90, namely large pelagic long-line (Figure 7).
Marine traffic	Most international shipping traffic is located on the outer edge of the continental shelf. PEL 90 is located within a main traffic route that pass around southern Africa (Figure 8).
Lüderitz	Lüderitz is a small, relatively well serviced town. The remoteness of the town has impacted on the economic opportunities and connectivity with the rest of Namibia. It is, however, well placed to handle investments, in that it has infrastructure and is able to provide water, power and other basic services.
Walvis Bay	Walvis Bay is an established, well serviced, medium sized, industrial harbour town. It is the most important harbour in Namibia. The town and its associated facilities, including the port services and accommodation, are sufficiently developed and have the capacity to cater for development projects.

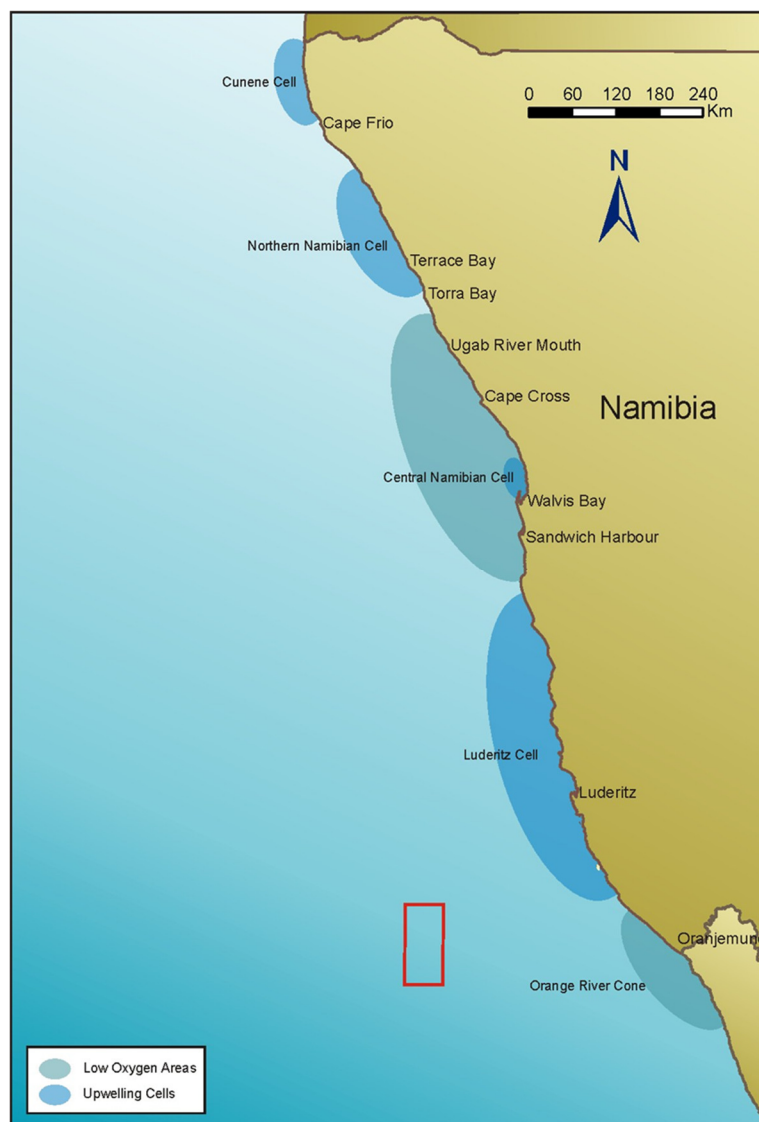


Figure 4: PEL 90 (red polygon) in relation to upwelling centres and low oxygen areas off the West Coast of Namibia. Adapted from: Shannon, 1995

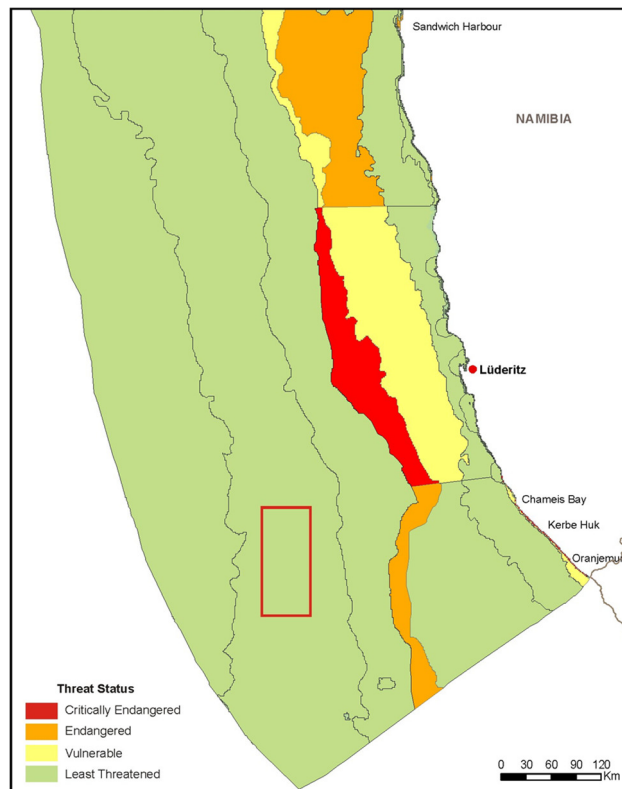


Figure 5: PEL 90 (red polygon) in relation to benthic ecosystem threat status. Adapted from: Holness *et al.*, 2014

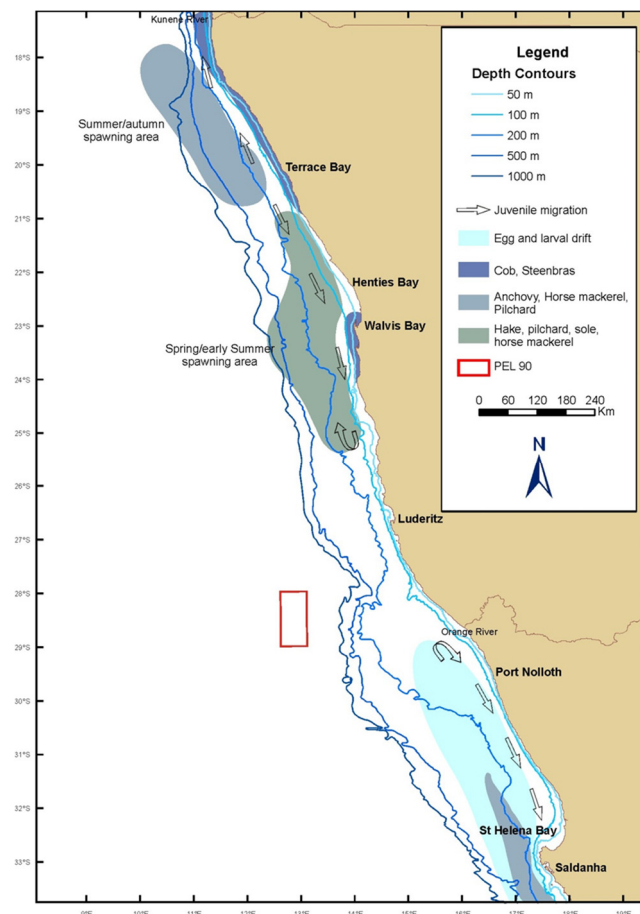


Figure 6: PEL 90 in relation to major fish spawning areas. Adapted From: Cruikshank, 1990; Hampton, 1992

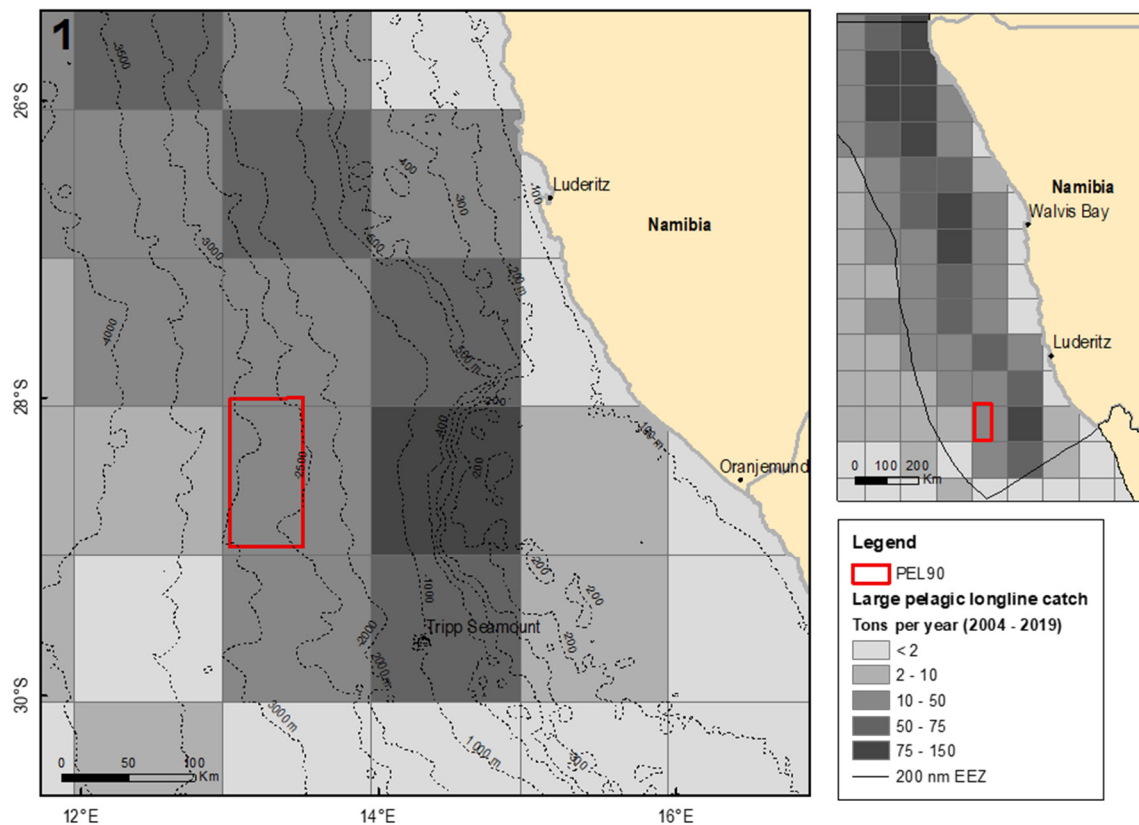


Figure 7: Large Pelagic Long-Line Catch (2004 – 2019). Source: CapMarine

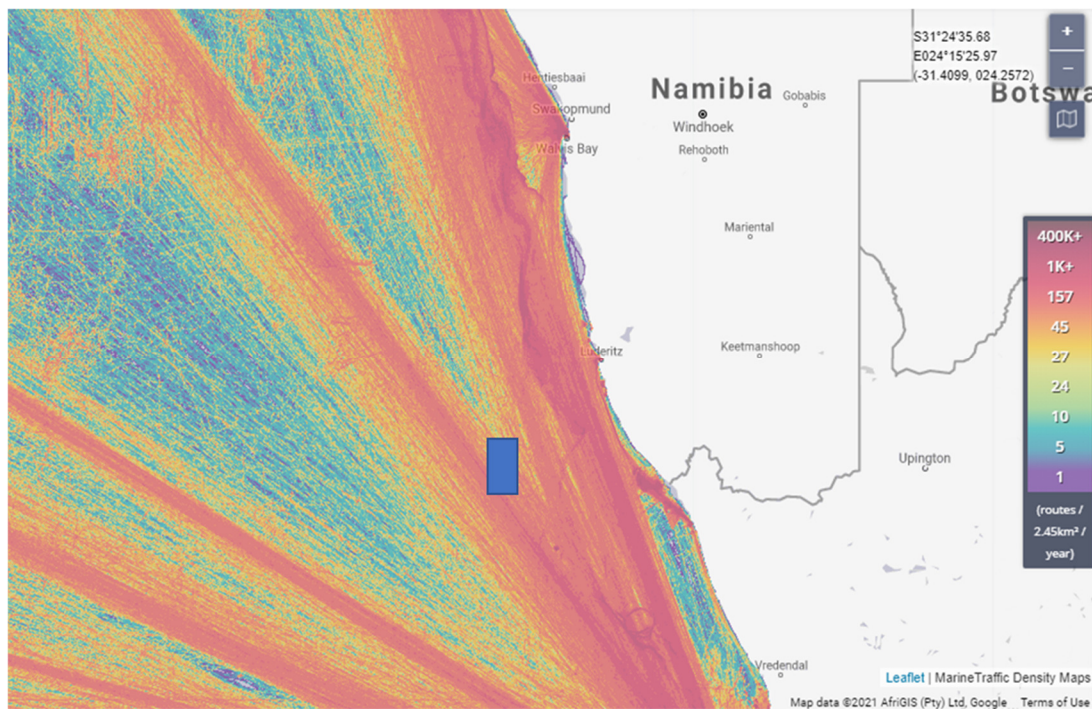


Figure 8: PEL 90 (blue polygon) in relation to shipping density off the West Coast of southern Africa.
Source: <http://www.marinetraffic.com/> (accessed February 2021)

5 IMPACT ASSESSMENT SUMMARY TABLE

A summary of the assessment of potential impacts and proposed mitigation is provided in Table 1 overleaf.

Table 1: Summary of the Significance of the Impacts Associated with the Proposed Speculative Seismic Survey in PEL 90

Note: (1) Neg = Negligible; VL = Very Low; L = Low; M = Medium; H = High; VH = Very High; +ve = Positive.
(2) * indicates that no mitigation is possible and/or considered necessary, thus significance rating remains.
(3) ** indicates that although the significance rating of the impact remains the same, the intensity of the impact decreases due to the proposed mitigation.

No.	Activities	Aspects	Impacts on Main Receptors	Pre-Mitigation Significance	Key Mitigation / Project Controls	Residual Significance
1	OPERATION OF VESSELS (SURVEY AND SUPPORT) AND HELICOPTERS					
1.1	Emissions to Atmosphere					
1.1.1	Emissions from the operation of the project vessels / helicopters	Increase of air pollutants	Local reduction in air quality	NEG	Compliance with MARPOL 73/78 Annex VI	NEG**
1.1.2			Contribution to global greenhouse gas emissions	NEG		NEG
1.2	Routine Operational Discharges to Sea					
1.2.1	Liquid and solid discharges to sea	Local reduction in water quality	Impact marine ecology/environment	VL	Compliance with MARPOL 73/78 Annexes I, IV and V	VL
1.2.1	Discharge of ballast water and vessel / equipment transfer	Potential introduction of alien invasive species	Impact of on marine biodiversity	VL	Compliance with IMO 2004 Ballast Water Management Convention	NEG
1.3	Noise from helicopters					
1.3.1	Helicopter operations	Increased ambient airborne noise levels	Impact on coastal and marine fauna	L	- Avoid sensitive areas - Maintain specified altitudes	L**
1.4	Underwater noise from project vessels transit					
1.4.1	Vessel operation	Increased underwater airborne noise levels	Impact on marine fauna	VL	None	VL*
1.5	Lighting from vessels					
1.5.1	Vessel operation (at night)	Increased ambient lighting	Impact on marine fauna	VL	Optimise lighting	VL**

No.	Activities	Aspects	Impacts on Main Receptors	Pre-Mitigation Significance	Key Mitigation / Project Controls	Residual Significance
2	SEISMIC ACQUISITION					
2.1	Underwater Noise from Sound Source					
2.1.1	Seismic acquisition / firing of the sound source	Increased underwater ambient noise levels	Impact on cetaceans	M	- Avoid key migration period - Pre-shoot watch (MMO & PAM) “Soft-start” procedures - MMO observation during surveying (daylight) - PAM during surveying (24/7) - Shut-downs	L
2.1.2						
2.1.3			Impact on seals	L	- Pre-shoot watch (MMO) “Soft-start” procedures - MMO observation during surveying (daylight) - Shut-downs	VL
2.1.4			Impact on turtles	M	- Pre-shoot watch (MMO) “Soft-start” procedures - MMO observation during surveying (daylight) - Shut-downs	L
2.1.5			Impact on penguins and feeding diving seabirds	L	- Pre-shoot watch (MMO) “Soft-start” procedures - MMO observation during surveying (daylight) - Shut-downs	VL
2.1.6			Impact on fish	M	- Pre-shoot watch (MMO) “Soft-start” procedures - MMO observation during surveying (daylight) - Shut-downs	L

No.	Activities	Aspects	Impacts on Main Receptors	Pre-Mitigation Significance	Key Mitigation / Project Controls	Residual Significance
2.1.7	Seismic acquisition / firing of the sound source	Increased underwater ambient noise levels	Impact on invertebrates	NEG	“Soft-start” procedures - Shut-downs	NEG**
2.1.8			Impact on plankton	NEG	None	NEG*
2.1.9			Impact on large pelagic longline fishing sector	VL	- Stakeholder notification - Navigational warning - Fisheries Liaison Officer (FLO) - Grievance mechanism	VL
2.1.10						
2.2	Temporary Safety Zone around Survey Vessel and Array					
2.2.1	Operation of seismic vessel	Temporary safety zone around survey vessel and array	Impact on large pelagic longline fishing sector	VL	- Stakeholder / vessel notification - Navigational warning - Vessel lighting - Grievance mechanism	VL
2.2.2						
2.2.3			Disruption to commercial shipping	L		L**
3	INTERACTION WITH THE LOCAL ECONOMY					
3.1	Employment and Business Opportunities					
3.1.1	Provision of services	Local employment and local business opportunities	Economic benefits for local service providers and suppliers	VL +ve	- Contracting of local companies - Manage community expectations - Stakeholder engagement - Grievance mechanism	VL +ve**
3.2	Use of Local Services and Facilities					
3.2.1	Provision of services	Use of local services and facilities	Pressure on local services and facilities	NEG	None	NEG*
4	UNPLANNED EVENTS					
4.1	Collisions with project vessels and equipment					
4.1.1	Ship strikes and entanglement	Obstruction on sea surface, seafloor or in water column	Health and safety impacts to shipping, coastal recreation and fishing	VL	- Emergency Response Plan - Stakeholder information - Navigation warning - Implement a grievance mechanism	VL**

No.	Activities	Aspects	Impacts on Main Receptors	Pre-Mitigation Significance	Key Mitigation / Project Controls	Residual Significance
4.1.2			Impacts on marine fauna	L	• ‘Turtle-friendly’ tail buoys • Reduced transit speed • Ensure all equipment used in other regions is thoroughly cleaned	L**
4.2	Accidental Release of Oil at Sea					
4.2.1	Vessel or equipment damaged and bunkering of fuel	Release of fuel into the sea and localised reduction in water quality	Impacts on marine ecology/environment	M	• Bunkering procedure • Shipboard Oil Pollution Emergency Plan – MARPOL Annex I • Emergency Response Plan and notification • Spill training and clean-up equipment	L
4.2.2			Impacts on large pelagic longline fishing and mariculture	VL		VL
4.3	Loss of Equipment at Sea					
4.3.1	Accidental loss of equipment	Obstruction on seafloor or in water column	Impacts on marine ecology/environment	VL	• Maintenance and lifting procedures • Retrieve of lost objects / equipment, where practicable • Notify Directorate of Maritime Affairs and the SAN Hydrographer	VL**
4.3.2			Impacts on large pelagic longline fishing	VL		VL**

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 NORMAL OPERATIONS

6.1.1 Operation of Project Vessels: Emissions, Routine Discharges, Lighting and Noise

The majority of the impacts associated with the normal operation of the project vessels will occur in the vicinity of the survey area, which is the offshore marine environment, more than 190 km offshore, far removed from coastal islands and any sensitive coastal receptors (e.g. key faunal breeding / feeding areas and bird or seal colonies). Tripp Seamount, which is an important subsea feature because it attracts an abundance of marine life and is a productive fishing ground, is also sufficiently far removed from the survey area (100 km to the south-east of the survey area) for it not to be impacted by the proposed survey. Since the survey area is located in a main traffic route that passes around southern Africa, potential impacts from normal operation of project vessels are not unique to the project vessels, but common to the numerous vessels that pass through Namibian coastal waters on a daily basis.

The dominant wind and current direction will ensure that any **emissions and discharges** move mainly in a north-westerly away from the seamount and coast. These impacts will largely be regional (although generally localised at any one time), of short-term duration (2.5 - 3 months) and of very low to low intensity, and are considered to range from **NEGLIGIBLE** to **VERY LOW** significance with mitigation. Key mitigation includes ensuring that the project vessels comply with the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL standards).

De-ballasting of project vessels could lead to the introduction of exotic species and harmful aquatic pathogens to the marine ecosystem. The risk of impacts on marine biodiversity related to the introduction of alien species is significantly reduced due by adherence to the 2004 International Maritime Organisation (IMO) guidelines governing discharge of ballast, which specifies minimum discharge distances from the nearest land. Considering the remote location and water depth of the survey area and compliance with the IMO guidelines for ballast water, the residual impact is considered to be of very low intensity in the short-term (due to invasive species not being able to establish) and of regional extent. Thus, the residual impact is of **NEGLIGIBLE** significance.

The **noise generated by the operation of the project vessels** falls within the hearing range of most fish and marine mammals, and would be audible for considerable ranges before attenuating to below threshold levels. However, underwater noise from vessels is not considered to be of sufficient amplitude to cause direct harm to marine life, even at close range. The impact related to vessel noise is considered to be of **VERY LOW** significance. PEL 90 is located with a main marine traffic route and thus is in an area already experiencing increased marine traffic and operational noise. No mitigation measures are proposed or deemed necessary.

Operational lighting used to illuminate the project vessels at night will increase ambient lighting in offshore areas, which may disturb and disorientate pelagic seabirds feeding in the area. However, seabirds and marine mammals will become accustomed to the presence of the project vessels within a few days. Since the survey area is located within a main marine traffic route, which experience high vessel traffic, animals in the area should be accustomed to vessel traffic. The residual impact related to vessel lighting is considered to be of **VERY LOW** significance.

6.1.2 Helicopter Operations

Crew changes will most likely occur by support or survey vessel calling to port. However, any possible helicopter flights between the survey area and the Lüderitz airport (or a suitable location nearby) may fly over or in close proximity to sensitive coastal receptors, such as Lüderitz lagoon, Atlas Bay, Wolf Bay and Long Islands, which could be affected by a flight path between the survey area and the Lüderitz airport. Although exposure will be limited over the two-month survey duration (short-term) and be of a temporary nature while the helicopter passes overhead (regional, although highly localised at any one time), indiscriminate or direct low altitude flying over seabird and seal colonies or breeding cetaceans could impact fauna behaviour and breeding success.

Specified flight paths that avoid of these sensitive receptors and maintaining an altitude of > 1 000 m will reduce the impact intensity on marine fauna to very low, but maintain the **LOW** significance.

6.1.3 Seismic Acquisition

Seismic noise could potentially impact marine fauna in a number of different ways, including physiological injury (e.g. Permanent hearing Threshold Shift, PTS and Temporary hearing Threshold Shift, TTS), disturbance and / or behavioural changes, masking of environmental sounds and communication, and effects on predator-prey relationships. Any impact to fish and fish behaviour could, in turn, impact commercial fisheries that operate in the area through the reduction in catch rates and/or an increase in fishing effort.

In order to assess the potential impact of seismic noise on marine fauna an underwater noise modelling study was undertaken. The maximum estimated zones of impact for PTS, TTS and behaviour for the various faunal groups are summarised in Table 2 below.

TABLE 2: ZONES OF IMPACT FROM SEISMIC PULSES FOR ALL FAUNAL GROUPS

Type of animal		Zones of impact – maximum horizontal distances from source to impact threshold levels					
		Immediate Impact from Single Pulses		Cumulative Impact from Multiple Pulses			Behaviour
		Injury (PTS) onset	TTS onset	Injury (PTS) onset	TTS onset		
Mammals	Cetaceans	430 m (VHF cetaceans)	840 m (VHF cetaceans)	300 m (LF cetaceans)	10 000 m (LF cetaceans)		4 400 m
	Seals	20 m	30 m	-	< 10 m		-
Type of animal		Mortality & Mortal Injury	Recovery injury	Mortality & Mortal Injury	Recovery injury	TTS	Behaviour
Fish	Fish (with swim bladder)	245 m	245 m	25 m	30 m-	1 500 m	high - moderate risk: tens to hundreds of meters) low risk: thousands of meters
	Eggs and larvae	245m	-	-	-	-	-
Sea turtles		245 m	-	20 m	-		2 400 m
Notes:							
• VHF = Very High Frequency; LF = Low Frequency • A dash indicates the threshold is not applicable. • If the zone of impact for cumulative is smaller than that for the single pulse, then the marine species are likely to be more sensitive to pressure impact than energy impact.							

It is evident from the table above that animals would need to be in relatively close proximity to the operating sound source to suffer physiological injury, and, most fauna in the survey area being highly mobile, it is considered likely that most would avoid sound sources at distances well beyond those at which injury is likely to occur. The cumulative zones of impact would only apply where the animals may not move away from the area during surveying, e.g. coastal zone or from mid-ocean focal sites such as Tripp Seamount. These key sensitive receptors, namely coastal zone (190 km inshore of the survey area) and Tripp Seamount (100 km from the survey area), thus falls well beyond the influence of the seismic pulses. Behavioural effects, with a zone of impact up to 4 400 m for cetaceans, are generally short-term with duration of the effect being less than or equal to the duration of exposure, although these vary between species and individuals, and are dependent on the properties of the received sound.

Although the zone of impact for zooplankton is relatively in close proximity to the operating sound source to suffer physiological injury (within 245 m of sound source), this faunal group cannot move away from the approaching sound source. This concurs with the findings of numerous studies, which generally identified that for a large seismic array mortalities and physiological injuries only occurred at very close range. Impacts will thus be of high intensity at close range. In considering the potential impact on zooplankton it was also necessary to consider the proximity of areas with high plankton productivity in relation to the survey area. The major spawning areas, as well as egg and larval drift pathways of commercially important species, such as hake, pilchards, horse mackerel and anchovy all lie well inshore and over 250 km to the north and south of the survey area. Tripp Seamount, which is an important feature as it contributes to localised shelf-edge upwelling and increased productivity, is also located beyond the influence of seismic pulses from within the proposed survey area. Due to the avoidance of these key areas, the proposed survey is unlikely to result in significant declines in zooplankton abundance.

With the implementation of the recommended mitigation, the residual impact on **marine fauna** ranges from **LOW** (cetaceans, turtles and fish) to **VERY LOW** (diving seabirds and seals) to **NEGLIGIBLE** (invertebrates and plankton / ichthyoplankton) significance. Key mitigation includes ensuring the seismic survey avoids the key cetacean migration period from June to November (inclusive), implementing a 60-minute pre-watch period and “soft-start” procedure, monitoring the faunal activity within the mitigation zone when the sound source is active and terminating seismic shooting, as specified.

Due to the remote location of the licence blocks, the survey area and associated zones of impact (see Table 2) only overlap with one commercial fishing sector, namely the Large pelagic longline. Over the period 2004 to 2019, the catch and effort within the licence blocks amounts to only approximately 0.2% of the total national landings and effort by the sector. Although the proposed survey may overlap with the key fishing periods for the large pelagic longline sector (March - May), catch recorded in the survey area is minimal and limited in extent in terms of behavioural avoidance from the firing sound source (4-5 km). With the implementation of the mitigation measures, which will ensure good communication and coordination with the large pelagic longline sector allowing them to focus fishing in other areas, the residual impact on the large pelagic longline is assessed to be of **VERY LOW** significance.

Similarly, **commercial shipping** would be excluded from portions of the survey area at any one time and may require these vessels to adjust their course slightly (detour) to avoid the survey vessel and lines being shot. Although the survey area is located within a main traffic route, with the implementation of the mitigation

measures, which includes the broadcasting of a navigational warning for the duration of the survey, residual impacts on commercial shipping is assessed to be of **LOW** significance.

6.1.4 Interaction with the Local Economy

The seismic activities will result in limited economic benefits with respect to the recruitment and the use of local service providers or suppliers. The demand for such local services will largely be limited to crew accommodation, meals, basic goods, and refuelling, provided at either Lüderitz or Walvis Bay, depending on which port is selected as the onshore logistics base. In addition, the workforce required for the exploration activities is expected to be 80 persons in total. Although the majority of these positions will be filled by international specialists employed by the seismic surveyor contractor, there will be indirect employment via the contracting of local service providers and suppliers. The maximisation of opportunities for locals will result in a residual impact to **VERY LOW (positive)** significance. Due to the limited nature of this work, it is important to actively manage community expectations related to local procurement, local content, and local employment opportunities.

6.2 UNPLANNED EVENTS

Unplanned events may conceivably occur as a result of accidents or abnormal operating conditions, including a vessel collision and faunal strikes, accidental spills from bunkering or a vessel accident, and lost equipment.

Movement of vessels between the survey area and the supply port may result in limited interaction with recreational and fishing boats that could lead to **vessel collisions** and related damage to vessels and death / injuries to humans. To be prepared for a collision event, the project will implement an emergency response system. As standard practice, an Emergency Response Plan and Medical Evacuation Plan will be implemented. Assuming compliance with port control and laws of the sea when navigating in the vicinity of the supply port, it is unlikely that collisions would occur and the potential residual impact is assessed to be of **NEGLIGIBLE** significance.

Faunal strikes with the project vessels or the towed array, although unlikely, may occur during vessel transit or surveying. The residual impact is considered to be of **LOW** significance with the use of 'turtle-friendly' tail buoys, ensuring that all equipment that has been used in other regions is thoroughly cleaned prior to and regularly during use (less likely to attract animals wanting to feed off organisms growing on the equipment) and reducing transit speed from 12 knots to 10 knots in the vicinity of sensitive marine fauna and within 25 km from the coast.

Oil or diesel spilled in the marine environment will have an immediate detrimental effect on water quality. Being highly toxic, marine diesel released during an operational spill (e.g. during bunkering, vessel or equipment damage) will negatively affect any marine fauna in which it comes into contact. In the unlikely event of a spill, the intensity of the impact would depend on whether the spill occurred in offshore waters where encounters with pelagic seabirds, turtles and marine mammals would be low due to their extensive distribution ranges, or whether the spill occurred closer to the shore where encounters with sensitive receptors will be higher. Due to the dominant winds and currents, a diesel slick in the survey area would be blown in a north-westerly direction and away from sensitive coastal receptors. A small diesel spill would remain at the surface for less than 5 days (short-term) with no chance of it reaching sensitive coastal habitats. A spill within the port limits during bunkering / loading could, however, be easily managed and contained, and is less likely to pose a risk to the nearshore environment. A spill outside the port near the coast (e.g. in the unlikely event of a vessel collision) could reach the shore and mariculture activities through wave action and tidal currents. As the intensity of a

nearshore spill may be higher than an offshore spill, the residual impacts on marine ecology and nearshore fishing (mariculture and small-scale) are considered to be of **LOW** significance, while the residual impacts on commercial fishing (offshore) are considered to be of **VERY LOW** significance. Key project controls include implementing the Shipboard Oil Pollution Emergency Plan and Emergency Response Plan.

The potential impacts associated with **lost equipment** to the seabed may initially crush benthic fauna, whereafter it would provide a localised area of hard substrate in an area of otherwise unconsolidated sediments. This would be of short-term duration as any lost object will likely sink into the sediments and be buried over time. Since the survey area does not overlap with demersal fishing grounds along the shelf break, snagging of demersal gear due to equipment that sinks to the seabed is not a risk to demersal fishing. The loss of a streamer would, however, result in entanglement and collision hazards in the water column before they sink under their own weight. The residual impacts on marine fauna and commercial fishing (e.g. pelagic longlines) are both considered to be of **VERY LOW** significance. Equipment and gear will be recovered, where possible, thereby reducing the likelihood of these impacts.

6.3 CUMULATIVE IMPACT

6.3.1 Bio-Physical

The assessments of impacts of seismic sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as scientific understanding of how such short-term effects relate to adverse residual effects at the population level are limited. Data on behavioural reactions to seismic noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term. Despite the density of seismic survey coverage over the past years in the southern Namibia and South African offshore, the number of Southern right and Humpback whales around the southern African coast have increased, suggesting that, for these species at least, there is no evidence of long-term negative change to population size or irreparable harm as a direct result of seismic survey activities. Although surveys have revealed a steady population increase since the protection of the species from commercial whaling, more recent results, however, indicate changes in the prevalence of southern rights on the South African breeding ground, including a marked decline of unaccompanied adults since 2010 and extreme fluctuations in the number of cow-calf pairs since 2015. The authors, however, contribute the change in demographics to likely spatial and/or temporal displacement of prey due to climate variability, and not seismic surveys. Information on the population trends of resident species of baleen and toothed whales is unfortunately lacking, and the potential effects of seismic surveys on such populations remains unknown. Consequently, suitable precautionary mitigation measures must be implemented during seismic data acquisition to ensure the least possible disturbance of marine fauna in an environment where the cumulative impact of increased background anthropogenic noise levels has been recognised as an ongoing and widespread issue of concern.

Although possible future activities cannot be reasonably defined and it is unlikely that concurrent exploration activities will occur at the same time as the Harmattan survey, with the implementation of the proposed mitigation measures, all potential impacts will be of short duration, typically ceasing once the survey is completed. **Such impacts are, therefore, considered unlikely to contribute to any future significant cumulative impacts, and thus no more significant than assessed in the preceding sections. For the current project, the existing knowledge from the peer-reviewed literature has been synthesised, and based on this information and**

(1) distance of the proposed survey area offshore, (2) distance of the survey area from Tripp Seamount, (3) distance from key fish spawning and nursery areas, (4) distance from key breeding areas for seabirds, turtles and marine mammals, and (5) location of the survey area in a major shipping route, cumulative ecosystem impacts are unlikely.

6.3.2 Socio-Economic

Seismic activities have been predicted to possibly affect the migration patterns of tuna leading to substantially reduced catches of tuna in southern Namibia. In the Benguela region, it has been suggested that the seasonal movement of Longfin Tuna northwards from the west coast of South Africa into southern Namibia may be disrupted by the noise associated with an increasing number of seismic surveys. While the potential exists to disrupt the movement of Longfin Tuna in the Benguela, this disruption, if it occurs, would be localised spatially and temporarily and would be compounded by environmental variability. In Australia, no direct cause and effect in changes in movement or availability of Bluefin Tuna could be attributed to seismic surveys, with observed changes being attributed to inter-annual variability. Due to the dearth of information on the impacts of seismic noise on truly pelagic species links between changes in migration patterns and subsequent catches thus remains speculative.

There is the possible chance of an increase in disturbance and disruption to fisheries active in the area (namely large pelagic longline) and pressure on local services and facilities should additional exploration activities commence (by either Harmattan or other exploration right holders) in a relatively short period. The operation of multiple exploration activities could result in cumulative pressure on local services and facilities. While Walvis Bay should absorb any parallel exploration activities, any cumulative impacts may be more apparent in the town and port of Lüderitz.

There is also the possibility of cumulative benefits being accrued to local services providers and suppliers if multiple exploration activities become active (by either Harmattan or other exploration right holders) either in parallel or in close sequence to each other. The need for ongoing support from local service providers and suppliers over multiple projects may see possible cumulative benefits over a longer period of time, but may also raise strong expectations.

With the implementation of the proposed mitigation measures, all potential impacts related to the proposed seismic survey will be of short duration, typically ceasing once the survey is completed. Such impacts are, therefore, considered unlikely to contribute to any future significant cumulative impacts, and thus no more significant than assessed in the preceding sections.

6.4 COMPARATIVE IMPACT EVALUATION OF ALTERNATIVES

A summary of the various project alternatives is provided in Table 3 below.

TABLE 3: COMPARATIVE ASSESSMENT OF ALTERNATIVES

Alternative	Conclusions
Survey area	Since Harmattan and its partners hold an Exploration Right for PEL 90, seismic surveying area will be largely limited to this area. This EIA assumes that the survey could be undertaken anywhere within PEL 90, as well as possibly an area 4 km to the south, east and west of the block, and that line turns could occur outside the survey area. Due to the remote location of the survey area in

Alternative	Conclusions
	relation to sensitive receptors (e.g. coast, Tripp Seamount and commercial fishing areas), any slightly changes to the survey area within the block will not alter the significance ratings of potential impacts.
Survey timing	Although Harmattan propose to commence with surveying in the Austral summer window, this EIA considered the implications of surveying at any time during the year. If the survey extends into the key cetacean migration period from June to November (inclusive) encounters with migratory whales to and from breeding grounds in equatorial West Africa are highly likely, which could result in a more significant impact and operations being shut-down. Thus, it is recommended that surveying avoid this period and, therefore, be undertaken between December and May (inclusive).
Onshore logistics base	An onshore logistics base will be located in either the Port of Lüderitz or the Port of Walvis Bay. The location of the onshore logistics base will ultimately be based on discussions with Namport and if there is sufficient berthing space to accommodate the support vessel. Although trips to Walvis Bay will be longer than to Lüderitz, and Lüderitz a slightly smaller port, all impacts related to vessel operation between the survey area and the port and onshore activities are considered to be of similar significance.
No-Go Alternative	The No-Go alternative represents the option not to proceed with the proposed seismic survey, which leaves the project areas of influence in their current state, except for variation by natural causes and other existing or approved human activities. Although Namibian Government policy supports exploration for indigenous hydrocarbon resources, the 'do nothing' option would limit seismic data acquisition from PEL 90 and southern Namibia. While exploration does not automatically lead to production, it is an essential stage in the industries' development cycle. If the proposed project is not carried out, Harmattan and its partners will have to reconsider their strategy for PEL 90, which could lead to plans being abandoned exploration and potential future development. In addition to promoting oil and gas exploration, Namibian Government policy also supports a reduction in GHG emissions and a transition to a lower carbon economy. The 'do nothing' option would, however, prevent relatively minor GHG emissions from occurring (exploration only). Exploration, as contemplated, has no direct effect on whether Namibian consumers use more or less oil or gas, nor on which types of fossil fuels contribute to the countries' energy mix. These aspects are influenced by Namibia's energy and climate change related policy, the financial costs of the various energy sources and consumer choices in this regard. Thus, undertaking the proposed seismic surveys versus the No-Go alternative is unlikely to have any direct influence on Namibia's reliance on hydrocarbons (importation), nor on GHG emissions from the consumption of oil or gas.

6.5 CONCLUDING STATEMENT

The work undertaken in support of this ECC Application has been completed in line with the applicable regulatory framework. A number of potential impacts are associated with the proposed seismic survey and associated activities. The assessment process followed included the undertaking of three specialist assessments deemed necessary to adequately identify and assess these potential impacts.

Following the impact assessment process, on the basis of the nature, duration (short-term) and extent (regional, although generally localised at any one time), the identified residual impacts related to normal operations are comparable to other seismic operations undertaken in the Namibian offshore and are assessed to be of **NEGLIGIBLE** to **LOW** significance with the implementation of the recommended mitigation measures. The

potential impacts can be adequately mitigated with the implementation of the proposed mitigation measures (as included in the EMP), which are in line with current industry good practice for seismic surveys undertaken in Namibian waters.

Despite the density of seismic survey coverage over the past years in south Namibian offshore, there is no evidence of long-term negative change (i.e. cumulative impacts) to faunal population sizes or irreparable harm as a direct result of seismic survey activities.

Based on the findings of the EIA and associated specialist studies, SLR is of the opinion that this EIA Report is sufficiently robust and provides sufficient information for MME and MEFT to make an informed decision on the proposed project taking into consideration the significance of potential impacts and National strategic policy issues relating to energy and climate change. SLR recommends that the commitments presented in the EMP should be conditional to the ECC, should MEFT approve the application.