Sequoia 3D Seismic Survey

ConocoPhillips

Underwater Sound Modelling and Controls | October 2020

ConocoPhillips Australia has commissioned independent experts in underwater acoustic modelling and monitoring to undertake underwater sound modelling as part of the development of the Sequoia 3D marine seismic survey (MSS) Environment Plan (EP). Underwater sound modelling is used to predict underwater sound levels expected to be produced by the Sequoia 3D MSS and the distances to effects on various marine fauna groups. This information sheet presents the results of the modelling undertaken to support the Sequoia 3D MSS in Exploration Permit T/49P.

What is the sound generated by marine seismic activities?

Marine seismic surveys involve the use of seismic source arrays that produce high intensity, low frequency air pulses. Sound is produced at regular intervals with the pulses directed primarily towards the seafloor. However, sound will also radiate at angles close to horizontal potentially spreading sound over long distances. The weakening of sound with distance is influenced by bathymetry, seabed composition and oceanographic properties such as temperature and salinity.

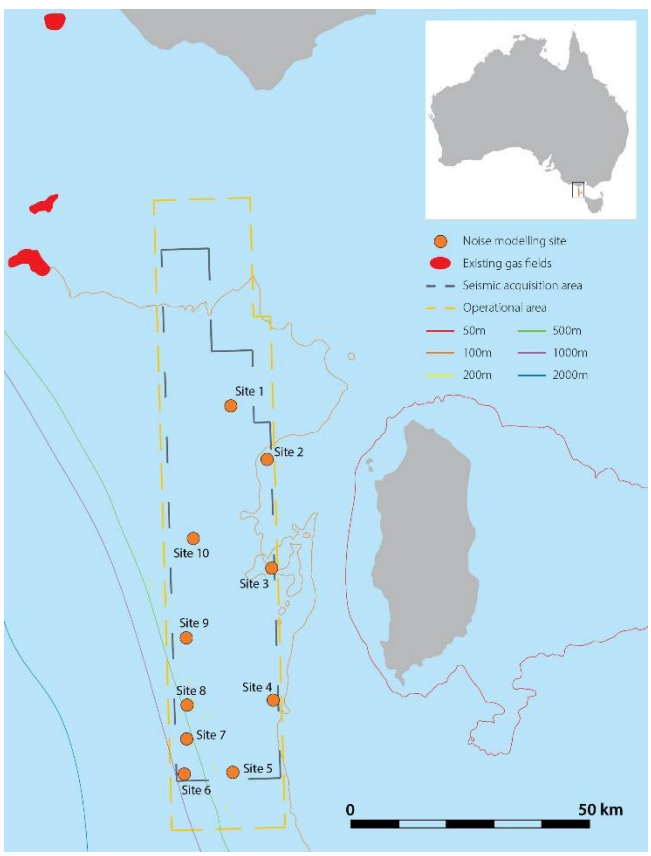
ConocoPhillips Australia has been working with geophysicists, environmental scientists, and seismic vessel contractors to ensure the sound levels from acoustic pulses are kept as low as possible while still meeting our survey objectives. Through this work, the acoustic source proposed for use is a 3,480 cubic inch array, which is a similar size to other marine seismic surveys recently undertaken in Australia.

What was the modelling approach?

Ten underwater sound modelling sites were selected, representative of the different water depths within the survey area. Two scenarios representing 24 hours of operation were considered to determine the accumulated sound levels (for relevant receptors).

How were the modelling sites chosen?

The survey lines were extracted from a nominal acquisition plan for the survey, and selected as they are representative of the range of bathymetry within the survey acquisition area along the continental shelf edge and continental slope that is relevant to Biologically Important Areas (BIAs) for pygmy blue whales and for southern right whales, as well as other key sensitive areas in the region, including the West Tasmanian canyons key environmental feature.



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How does the proposed seismic survey impact marine life?

ConocoPhillips Australia has used guidelines developed from the best scientific evidence available to inform the EP and continues to keep abreast of all research being released.

There have been numerous studies on the effects of underwater sound on marine receptors with a range of effects identified. Marine seismic surveys in Australia are well regulated and there is Australian and international guidance available for managing potential impacts to sound-sensitive marine fauna.

Sound-sensitive fauna, like whales, fish, seals, and invertebrates (e.g., rock lobsters and giant crabs) are identified as residing in or migrating through the survey area. There is potential for the Sequoia 3D MSS to impact this fauna. The research indicates that these results are generally temporary and localised.

The EP will present the environment impact assessment for each receptor group based on the most relevant thresholds using the latest science.

Understanding the acquisition window

While we expect to be acquiring seismic over a 60-day window, we will be recording seismic data using the seismic acoustic pulses for approximately 30 days. The 60-day window allows for downtime associated with bad weather and/or environmental restrictions such as the presence of whales.

Maximum horizontal distances for species in the water column

The table below outlines the maximum horizontal distance to noise effect criteria from the seismic sound pulse for single-impulse (PK) modelled sites and cumulative modelled sites for pelagic fauna.

The modelling predictions presented in the table represent the variation in results for the 10 modelling sites, which range in water depths from 69 m to 798 m. It is important to note that in accordance with the requirements of the various criteria, only the furthest distance to reach threshold criteria is reported, regardless of whether this is in the water column or seabed, single pulse or 24-h exposure.

Fauna group	Behavioural	Injury or Impairment			Mortality/ potential mortality	Notes
		Temporary Threshold Shift (TTS)	Permanent Threshold Shift (PTS)	Recoverable injury		
Plankton	*	*	*	*	210 m	There are no scientifically accepted criteria for injury or behaviour to model against.
Cephalopods (octopus & squid)	3.66 km	*	*	*	*	The behavioural threshold reported here is that at which inking has been observed. For this survey, it is predicted that the maximum distance in which this may occur is 3.66 km from the sound source. No other metrics for effect are currently available.

Maximum horizontal distances for species in the water column continued

Fauna group	Behavioural	Injury or Impairment			Mortality/ potential mortality	Notes
		Temporary Threshold Shift (TTS)	Permanent Threshold Shift (PTS)	Recoverable injury		
Cetaceans – low frequency (LFC) (e.g., blue, humpback, southern right whales)	11.1 km	56.6 km$^{\mu}$	1.18 km	*	*	The SEL_{24h} is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixedposition. More realistically, marine mammals would not stay in the same location for 24 hours, but rather a shorter period, depending upon their behaviour and the proximity and movements of the source. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either PTS or TTS) if it remained in that location for 24 hours.
Cetaceans – mid-frequency (MFC) (e.g., dolphins)		80 m	<20 m	*	*	
Cetaceans – high-frequency (HFC) (e.g., Kogia)		620 m	340 m	*	*	
Fur-seals (otarrid pinnipeds)	5.4 km	80 m	<20 m	*	*	Refer to Notes for low and mid-frequency cetaceans on the accumulation of SEL.
Turtles	1.66 - 5.43 km$^{\pm}$	500 m	80 m	*	*	There is limited information on turtle hearing. Refer to Notes for low and mid-frequency cetaceans on the accumulation of SEL. Turtles are likely to be presentonly as vagrants in and around the survey area.

Maximum horizontal distances for species in the water column continued

Fauna group	Behavioural	Injury or Impairment			Mortality/ potential mortality	Notes
		Temporary Threshold Shift (TTS)	Permanent Threshold Shift (PTS)	Recoverable injury		
Fish (with no swim bladders, including sharks)	Near^ – high risk Intermediate ^ –moderate risk Far^ – low risk	2.55 km	*	80 m	81 m	Mortality is likely only within very close distance to the sound source (up to 70 m in the water column and 80 m at the seabed), noting that studies to date have not demonstrated mortality of adult fish. Distances to mortality or recoverable injury from 24 hrs of cumulative impact reduce to a distance of 80 m (and are not triggered for fish living near the seabed).
Fish (with swim bladders, involved and not involved in hearing)	Near – high risk Intermediate – moderate to high risk Far – low to moderate risk	2.55 km	*	170 m	170 m	Distance to recoverable injury (e.g., loss of sensory hair cells) is 170 m in the water column. Many fish species sense sound pressure through gas-filled chambers called swim bladders. Mortality is likely only within very close distance to the sound source (up to 170 m in the water column), noting that studies to date havenot demonstrated mortality ofadult fish. Distances to mortality or recoverable injury from 24 hrs of cumulative exposure reduce to a distance of 80 m (and are not triggered for fish living near the seabed), noting that fish in the survey area are unlikely to remain within 80 m of the moving sound source for a continuous period of 24 hours.
Fish eggs and larvae	Near – moderate risk Intermediate – low risk Far – low risk					

In accordance with the requirements of the various criteria, only the furthest distance to reach threshold criteria is reported, regardless of whether this is in the water column or seabed, single pulse or 24-hour exposure.

** No exposure criteria is available to measure against.*

^ Near = tens of metres, intermediate = hundreds of metres, far = thousands of metres.

± Depending on the exposure criteria applied.

µ Noting that the MSS will be acquired when these whales are not present in the region.

Maximum horizontal distances for benthic invertebrate species

The below table outlines maximum horizontal distance to particle motion exposure for benthic invertebrates.

Fauna group	Behavioural	TTS	PTS	Risk of recoverable injury	No effect	Assessment
Sponges and coral	*	*	*	*	4 m	The threshold adopted is the distance to no impacts, that is, beyond 4 m from the centre of the array, directly below the source, there is no impact to sponges or corals.
Crustaceans (giant crab, rock lobster)	*	*	*	414 m	*	The threshold adopted here is a pseudo-threshold in so far as a scientifically agreed threshold has yet to be decided. The maximum distance to effect of 138-414 m (depending on water depth) is based on comparison against the sound pressure noted as causing damage to mechano-sensory systems (but not mortality).
Bivalves (scallops)	*	*	*	*	214 m	The various thresholds adopted here are pseudo-thresholds in so far as a scientifically agreed threshold has yet to be decided. The maximum distance to effect of 138-214 m (depending on water depth) is based on comparison to the results of various studies on scallops in 2016, 2017 and 2019 noted as resulting in chronic effects that could result in mortality in the weeks and months following exposure.

** No formal or defined exposure criteria is available to measure against*

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How will ConocoPhillips Australia reduce the impact of underwater sound?

ConocoPhillips Australia will put in place a range of controls to minimise the risks of underwater sound to marine life to as low as reasonably practical. The controls are listed in the table here and will be refined as the survey planning and the EP preparation progress.

Control Category	Controls
Compliance with regulation	The survey will be conducted in compliance with EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: Industry Guidelines.
Survey Timing	The survey will be acquired in the months that have the least impact to sensitive receptors such as commercial fisheries (e.g. rock lobster and giant crab) and sensitive fauna (e.g. pygmy blue whale migration and foraging). The window of least impact to most species is in the September to October timeframe. That is why we are applying for the August to October timeframe with a preference for a 60-day window in September to October for seismic acquisition.
Survey Design	The survey will use the lowest sound pressure to achieve the desired data quality.
	The survey will optimise its operational area to reduce the area of impact.
	The survey will use ConocoPhillips CSI Technology, which significantly reduces the duration of seismic activity compared to conventional methods. More information on the CSI Technology can be found on our website.
	The extent of the survey area is designed to reduce the likelihood of having to return to acquire more data at a later time.
Operational Controls	The survey will limit the number of days where seismic is actively acquired.
	Two dedicated trained and experienced marine fauna observers will be stationed on the survey vessel for the duration of the survey
	Survey and support vessel crews will be inducted to ensure they are aware of the EPBC Guideline 2.1 requirements and methodologies to undertake visual assessment for marine fauna species.
	Operations will include : • A.3.1: Pre-startup visual observation • A.3.2: Soft-start procedures • A.3.3: Start-up delay procedures • A.3.4: Operational procedures (shut-down on line turns) • A.3.5: Stop work procedures • A.3.6: Night-time and low visibility procedures.
	There will be no discharge of the acoustic source outside the survey operational area.
	In the event of another survey operating at the same time, procedures will be in place to ensure that a minimum 40 km separation is maintained between seismic surveys

Detailed Information

Detailed information on the Sequoia 3D MSS underwater sound modelling and controls will be available in the Environment Plan.

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