

Eureka 3D

MARINE SEISMIC SURVEY

Fremantle, Cervantes & Geraldton 6-8 June

**WRLC Meetings -
Assessment of seismic noise
effects on rock lobster**

Introduction



- Thank you to WRLC for enabling this sessions.
- Introductions to Pilot Energy team.
- Agenda:
 - The Regulations and consultation requirements with fishers.
 - An intro to Pilot Energy and the Eureka MSS acquisition area.
 - The known and unknown effects of seismic sound on rock lobsters.
 - Possible control measures to mitigate and manage impacts to WRL.
 - Q&A with the Pilot Energy team
- Assumption:
 - Your functions, interests, and activities as rock lobster fishers may be affected by the Eureka 3D MSS.

Consultation Requirements



- Purpose of today's session:

Provide 'initial information' about the Eureka 3D MSS for you to determine if you are a 'relevant person'.

Provide 'sufficient information' to make an informed assessment of the possible consequences on your functions, interests, and activities.

Understand how to proceed with the consultation process.

Introduction to Pilot Energy

About Us

- Publicly listed, junior oil & gas exploration & production company
- Exploring for oil & gas to supply domestic market
- Diversifying / transitioning to development of clean energy projects in Western Australia utilizing existing oil and gas tenements & infrastructure (e.g. Cliff Head wells and platform)

Asset Areas

- WA-481-P (conventional oil and gas exploration permit, located in Federal waters, offshore WA) (Pilot 100% interest and operator)
- Cliff Head Oil Field (conventional oil production, located in Federal waters, offshore WA) (Pilot 21.25% interest)

Other

Website

<http://www.pilotenergy.com.au/>

Company size

11-50 employees

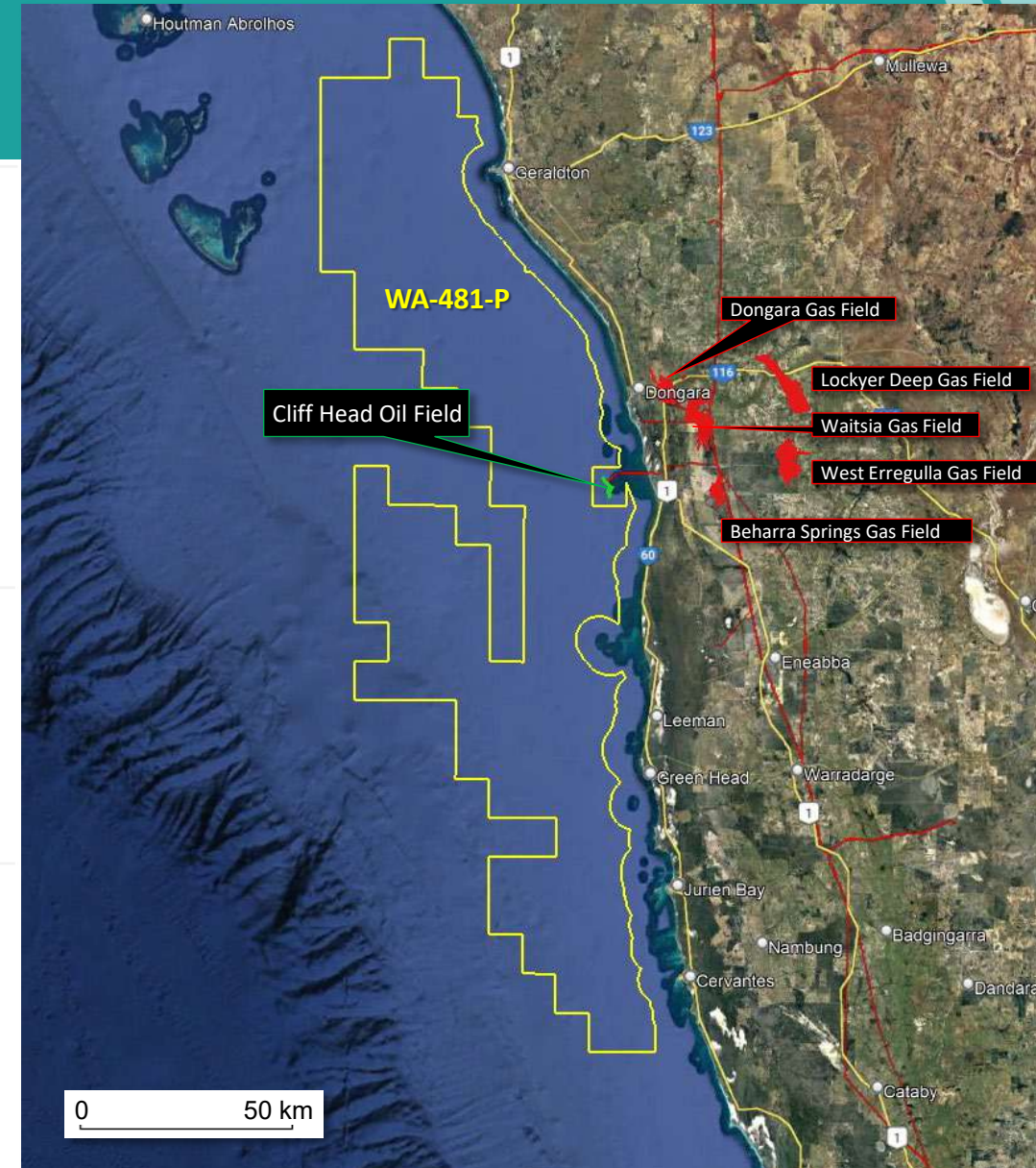
Headquarters

Sydney, New South Wales

Specialties

Energy, Renewables, and hydrogen

ASX : PGY



What is 3D Seismic ?



Sound waves (air) sent into earth by towed source, reflect off rock layers and reflections measured back at surface by “hydrophones” towed at shallow depths of < 10 metres by boat

3D Seismic Data Gathering

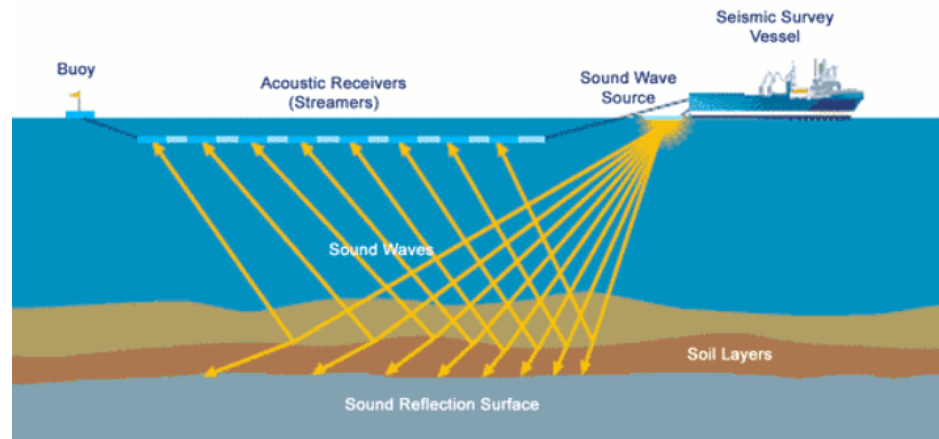
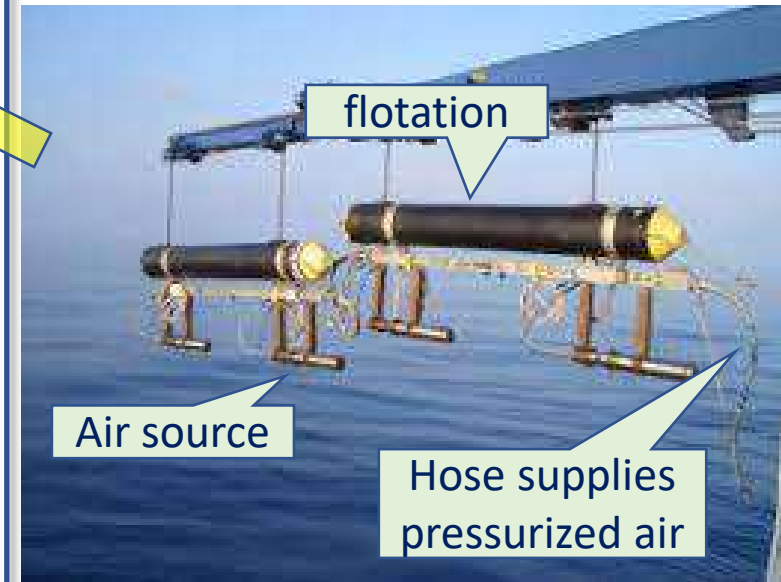
= “Ultrasound of the Earth”

3D Seismic Surveying - Equipment

**Sound Wave Receivers
("hydrophone streamers")**

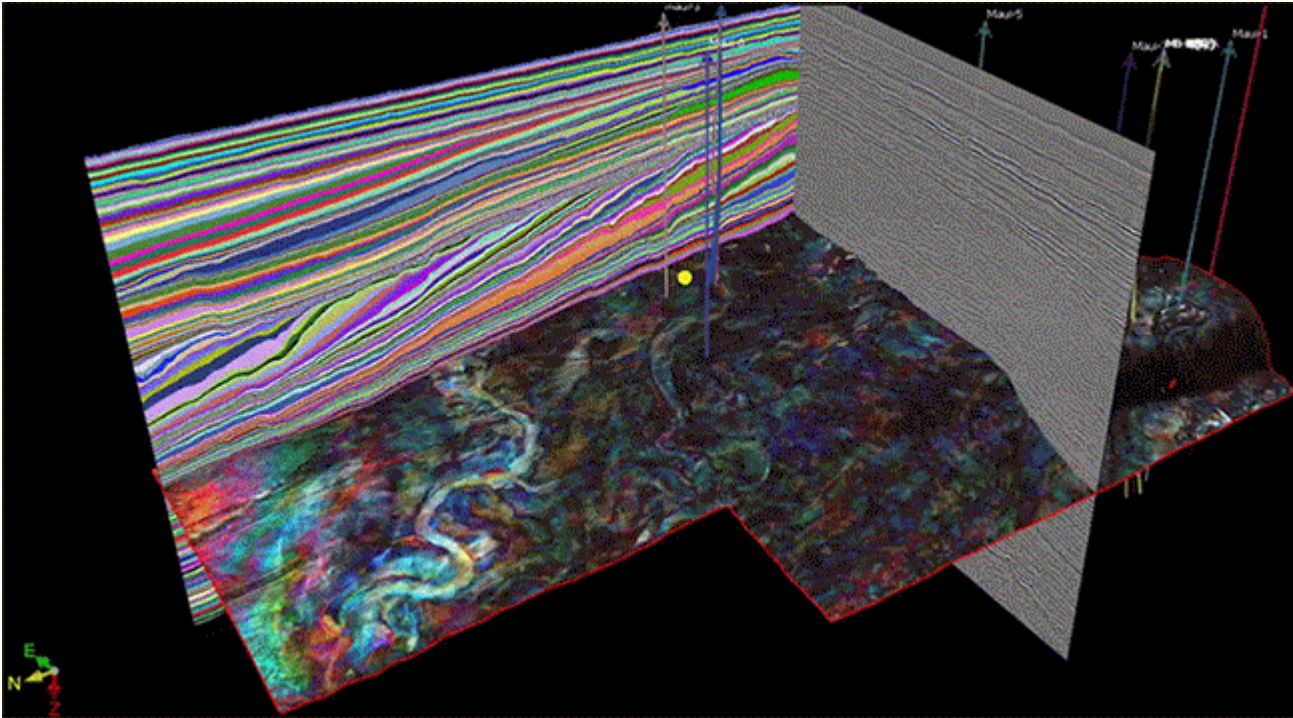


**Sound Wave Source
("airguns")**



Eureka 3D Seismic Survey - Purpose

3D Seismic data is gathered to image the rock layers in the earth to determine optimal locations for deep, oil and gas drilling (at ~ 3000 metres)



3D image of earth after processing of acquired data



Typical 3D acquisition boat configuration

Eureka 3D Seismic Survey - Location



Species Sensitivity (1)

- Crustaceans lack a gas-filled bladder and are unable to detect the sound pressure component of sound waves
- Rock lobster detect sound by sensing the particle motion component of sound in water through sensory hairs, statocysts and muscles
- Most research on seismic impacts on invertebrates characterises received sound levels in terms of sound pressure

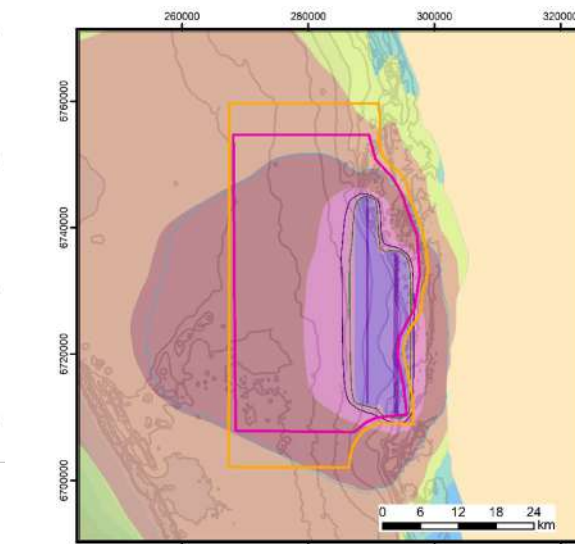
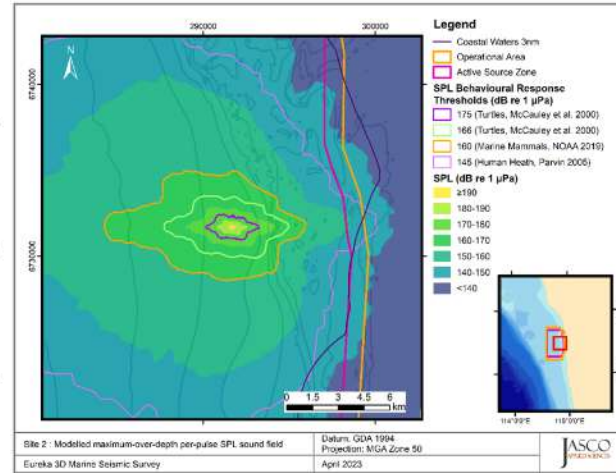
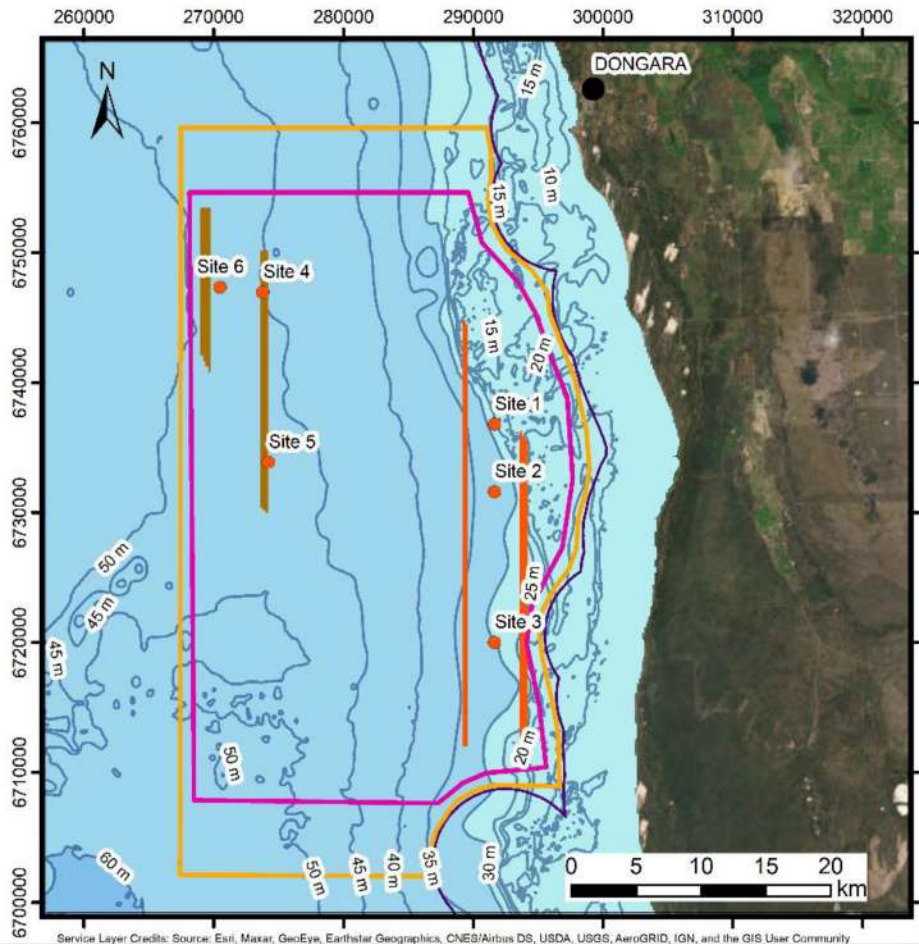


Species Sensitivity (2)



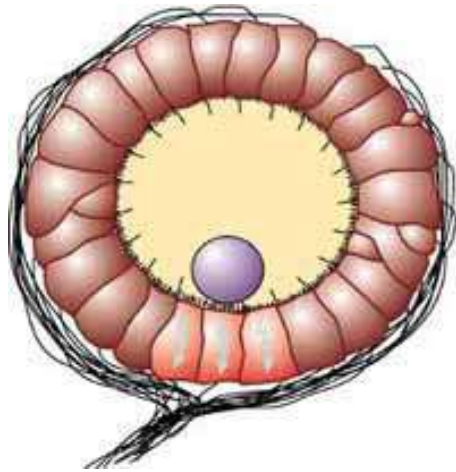
- Particle motion, rather than sound pressure, is a more important factor for crustaceans such as rock lobster
- Water depth and seismic source size are related to particle motion levels at the seafloor
- Larger arrays and shallower water are related to higher particle motion levels, and are thus more relevant to effects on crustaceans

Noise Modelling Study



- Numerical modelling to derive underwater sound levels to predict potential impacts on key receptors, including benthic invertebrates such as rock lobster
- Received sound levels estimated at six sites, to account for variable coastal features and water depth
- Considered both sound pressure and particle motion metrics
- Outputs compared to internationally accepted sound exposure thresholds for different receptors

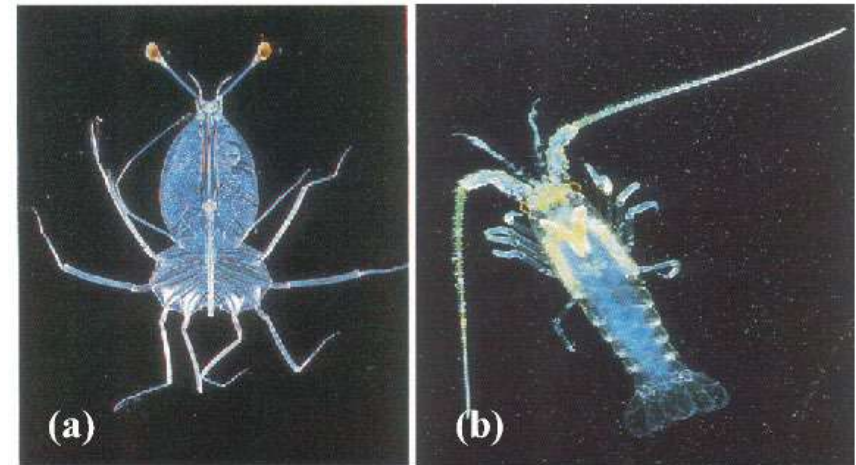
Sound Exposure Thresholds (1)



- Current literature does not define an appropriate metric or identify relevant levels (pressure or particle motion) for an impact assessment, including consideration of what particle motion levels lead to a behavioural response or other effects in crustaceans
- As the literature does not provide information on what levels of particle motion may cause effects, a precautionary approach has been applied by using conservative sound pressure metrics for rock lobster:
 - 202 dB re 1 μ Pa (Payne et al. 2008) - no effect level
 - 209–212 dB re 1 μ Pa PK-PK (Day et al. 2016a)
 - 213 dB re 1 μ Pa PK-PK (Day et al. 2019)
- Received sound levels of 209-212 dB re 1 μ Pa PK-PK are potentially associated with some level of sub-lethal effects in rock lobster

Sound Exposure Thresholds (2)

- Particle acceleration threshold of 37.57 ms^{-1} was also used (Day et al. 2016b; scallops)
- For mortality / potential mortal injury (PMI) effects in zooplankton (WRL larval stages) Popper et al. (2014) conservative thresholds of 210 dB re $1 \mu\text{Pa}^2 \cdot \text{s}$ ($\text{SEL}_{24\text{h}}$) and 207 dB re $1 \mu\text{Pa}$ (PK) were used
- Research generally suggests limited impacts to plankton beyond approximately 10 m distance from seismic sources
- These precautionary thresholds for larval mortality / PMI have been selected to indicate magnitude and extent of potential impacts from acquisition of the survey



Results for WRL – Seafloor PK-PK

PK-PK (L_{pk-pk} ; dB re 1 μ Pa)	Water Depth							
	10 m	12.5 m	15 m	20 m	25 m	30 m	40 m	50 m
	Distance R_{max} (m)							
213 ^{1,2,3}	83	73	85	90	92	94	103	86
212 ^{2,3}	86	88	89	103	100	100	111	121
210 ^{1,2}	101	130	123	110	122	136	120	133
209 ^{1,2}	112	132	150	124	126	141	167	145
202 ⁴	206	251	292	228	247	254	276	228

- At a sound exposure threshold of 209 dB re 1 μ Pa PK-PK, the maximum predicted range to sub-lethal effects is **167 m**
- Maximum 'no effect' distance for adult rock lobster is **292 m**, based on a sound level of 202 dB re 1 μ Pa PK-PK

Results for WRL – Seafloor PM

Hearing group/animal type	Peak Acceleration Magnitude (m/s ²)	Water Depth							
		10 m	12.5 m	15 m	20 m	25 m	30 m	40 m	50 m
		Distance $R_{\max}$ (m)							
Benthic invertebrates	37.57	58	48	44	40	43	47	54	7

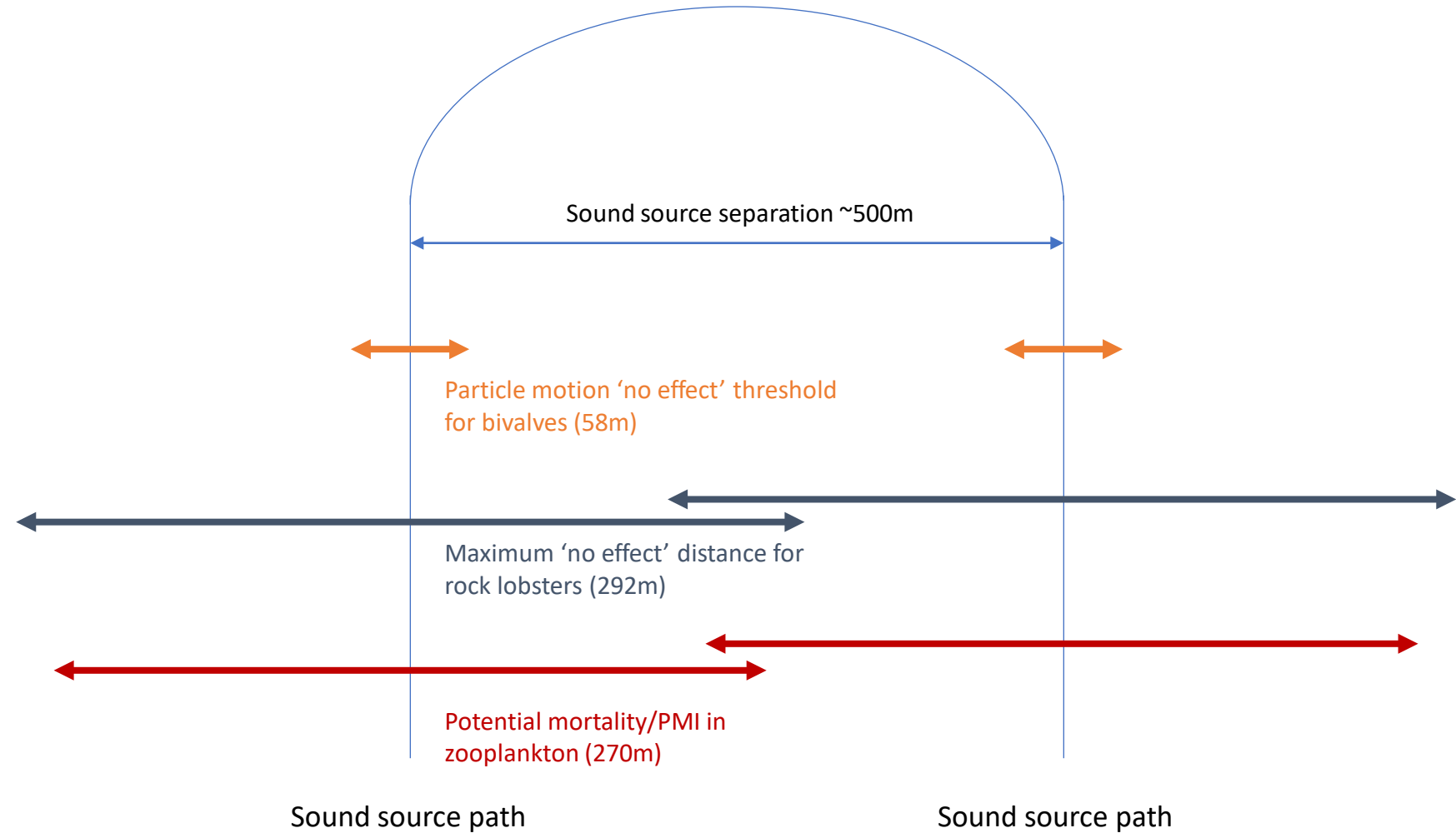
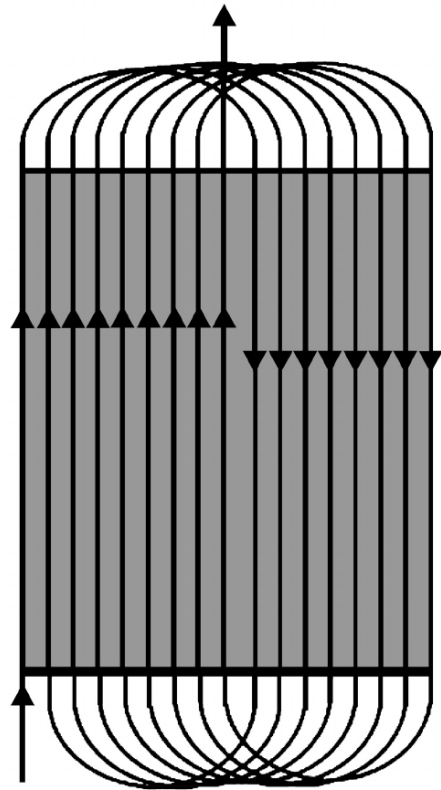
- Maximum distance to 'no effect', based on particle acceleration metric, is **58 m** – but this is more representative of potential effects to bivalves rather than rock lobster

Results – WRL Larval Stages

Receptor	Threshold	Distance $R_{\max}$ (km)	
		Site 4 (30 m)	Site 6 (47 m)
Fish eggs, and larvae	213 dB re 1 μPa^2 s ($\text{SEL}_{24\text{h}}$)	0.06	0.06
	207 dB re 1 μPa (PK)	0.27	0.24

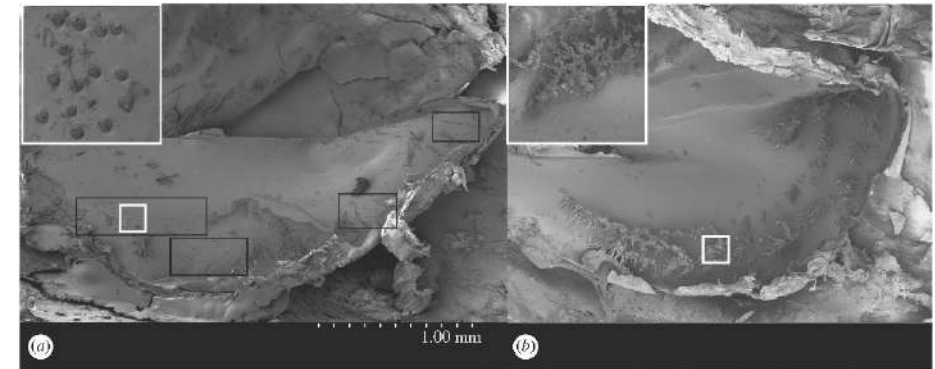
- Potential mortality/PMI in zooplankton out to range of **270 m**

Effect Levels Summary

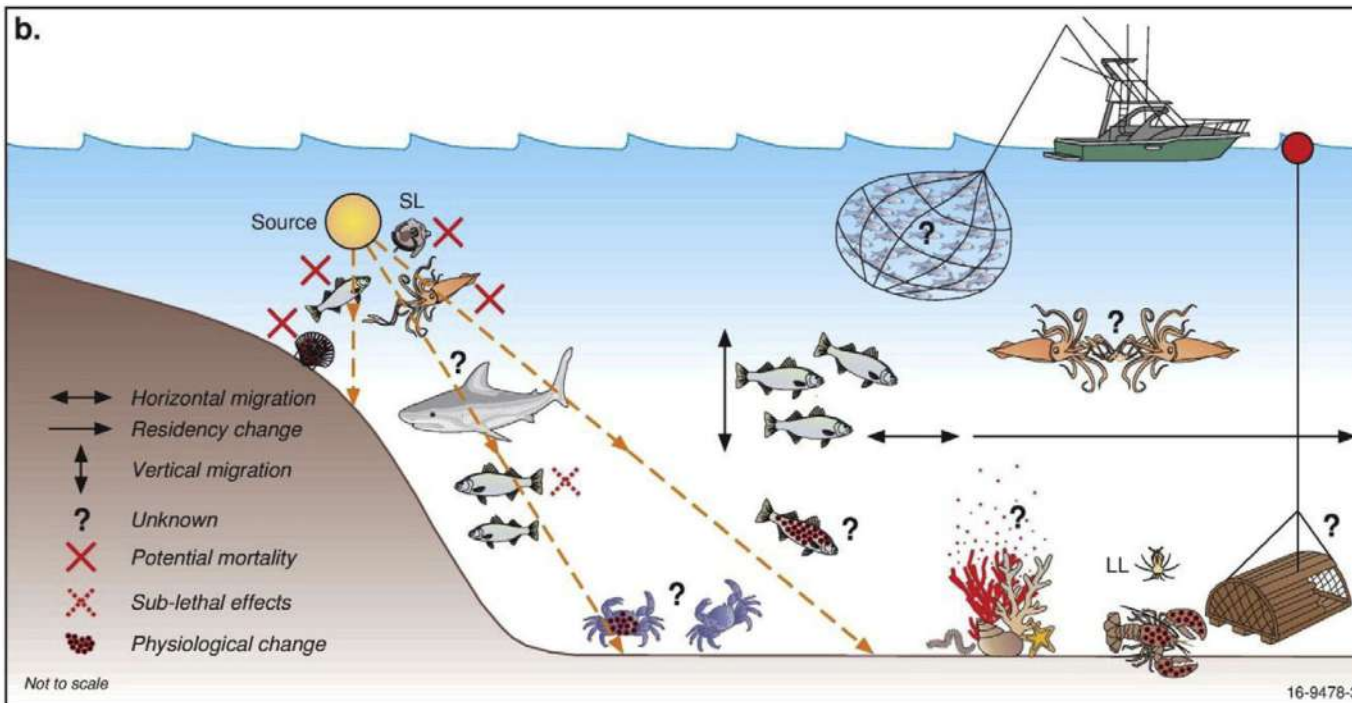


Impact Assessment Conclusions

- Potential for some rock lobster to experience some **low-level, sub-lethal effects** (e.g. impairment of reflexes, damage to statocysts and reduction in numbers of haemocytes)
- These sub-lethal effects could result in a **reduction in fitness to some individuals**, but impacts at a population level would be unlikely
- **Consistent with SRL research findings** (Day et al. 2016a; Fitzgibbon et al. 2017; Day et al. 2019, 2021, 2022)
- No indication from the UTAS studies that that sub-lethal effects in adult SRL affects 'catchability'



Information Gaps



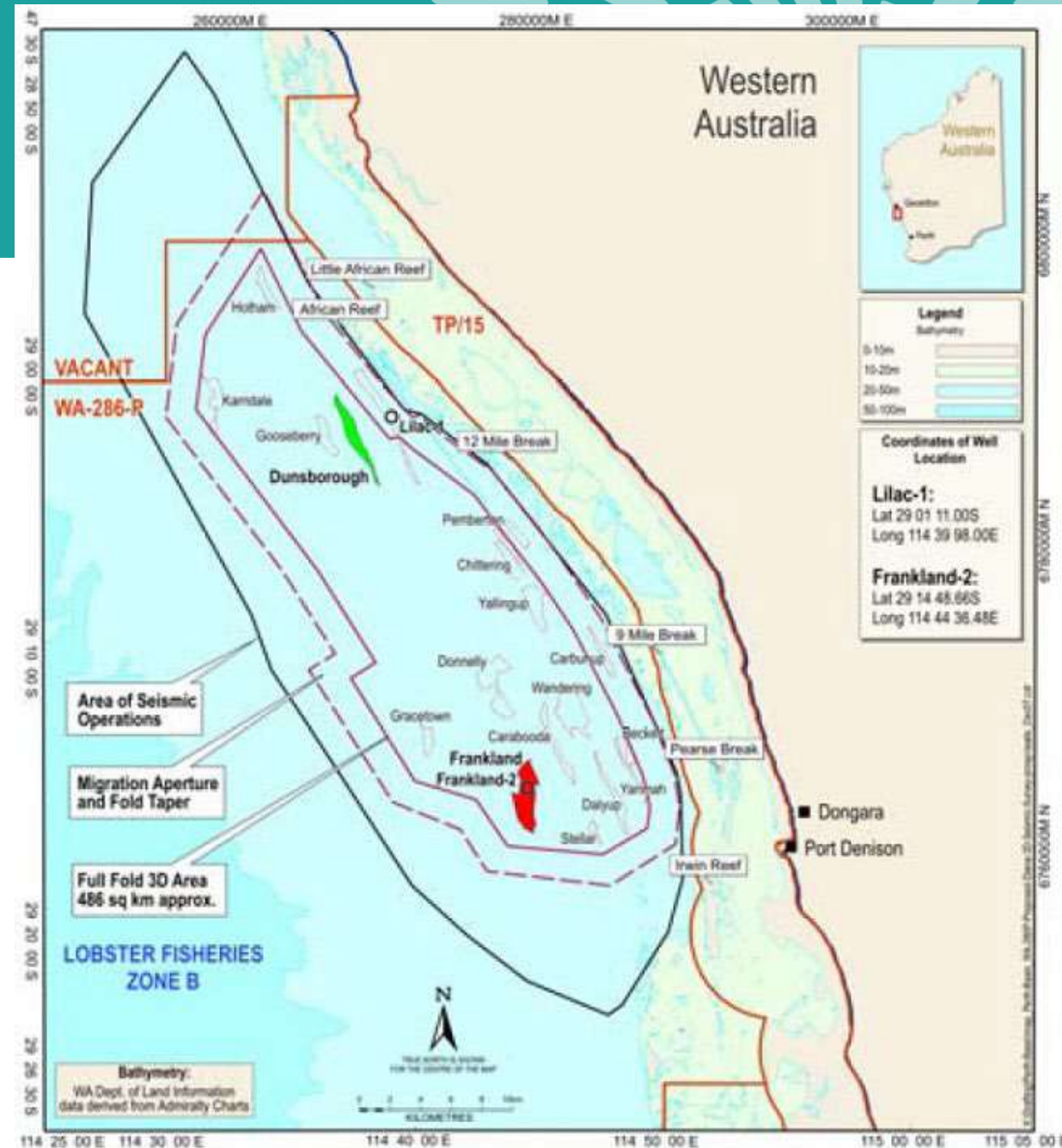
Source: Carroll et al. (2017)

Very limited research on effects of seismic noise on WRL:

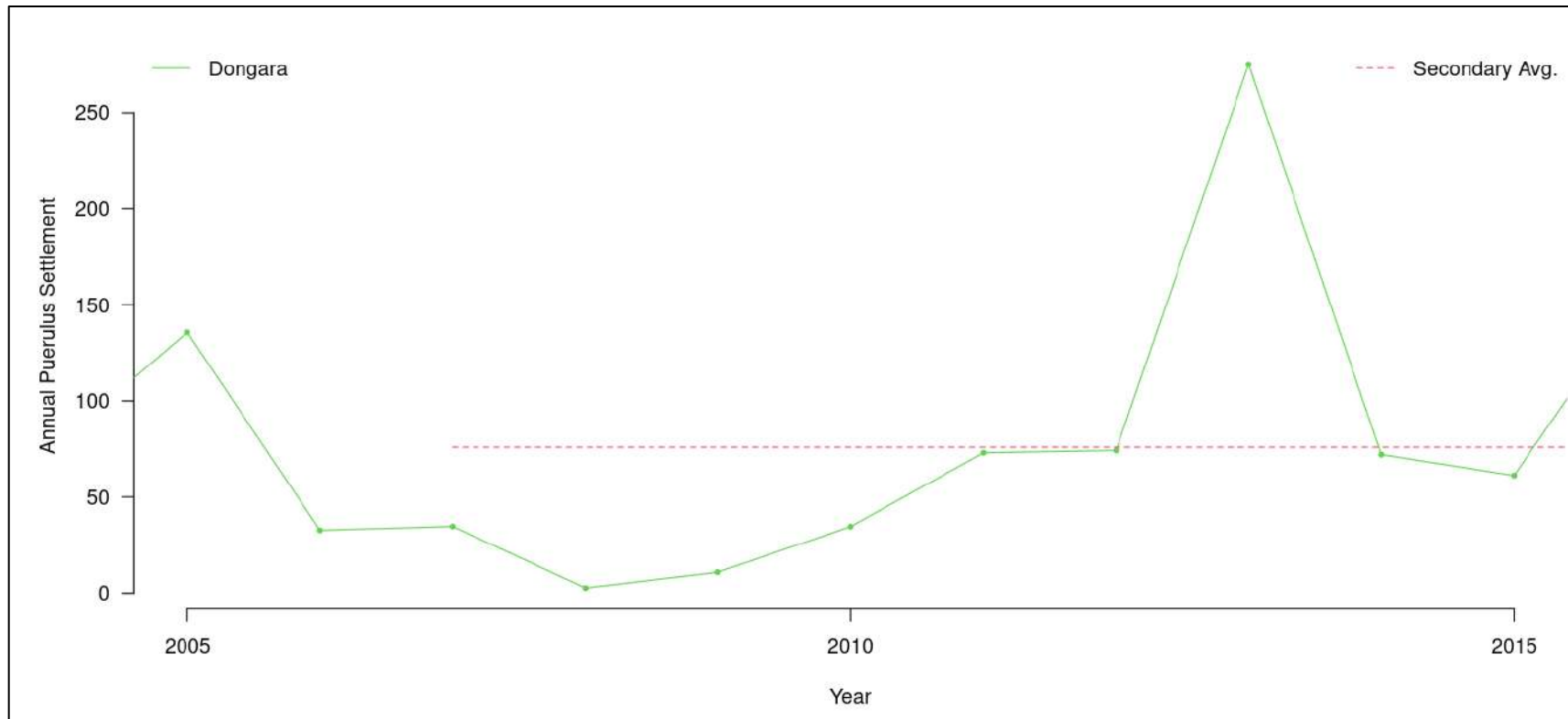
- DPIRD Fisheries Research studies on Xanadu 3D MSS and Alkimos Desalination Project geophysical site survey
- No results/conclusions from either study currently available
- When released, these findings will have to be taken into account for Eureka 3D MSS EP
- No studies have examined potential effects of seismic surveys on catch levels of WRL

Diana 3D MSS

- ~600 km² 3D survey acquired for ROC Oil in WA-286-P
- Acquired over ~40 days in Jan-Feb 2008 in water depths 20 – 50 m
- WRL catch data sourced from FishCube for period 2006 – 2010
- Catch data limited to 60 x 60 nm Catch & Effort System (CAES) blocks for 2006-2009
- Data resolution too coarse to determine any effect on WRL catch levels

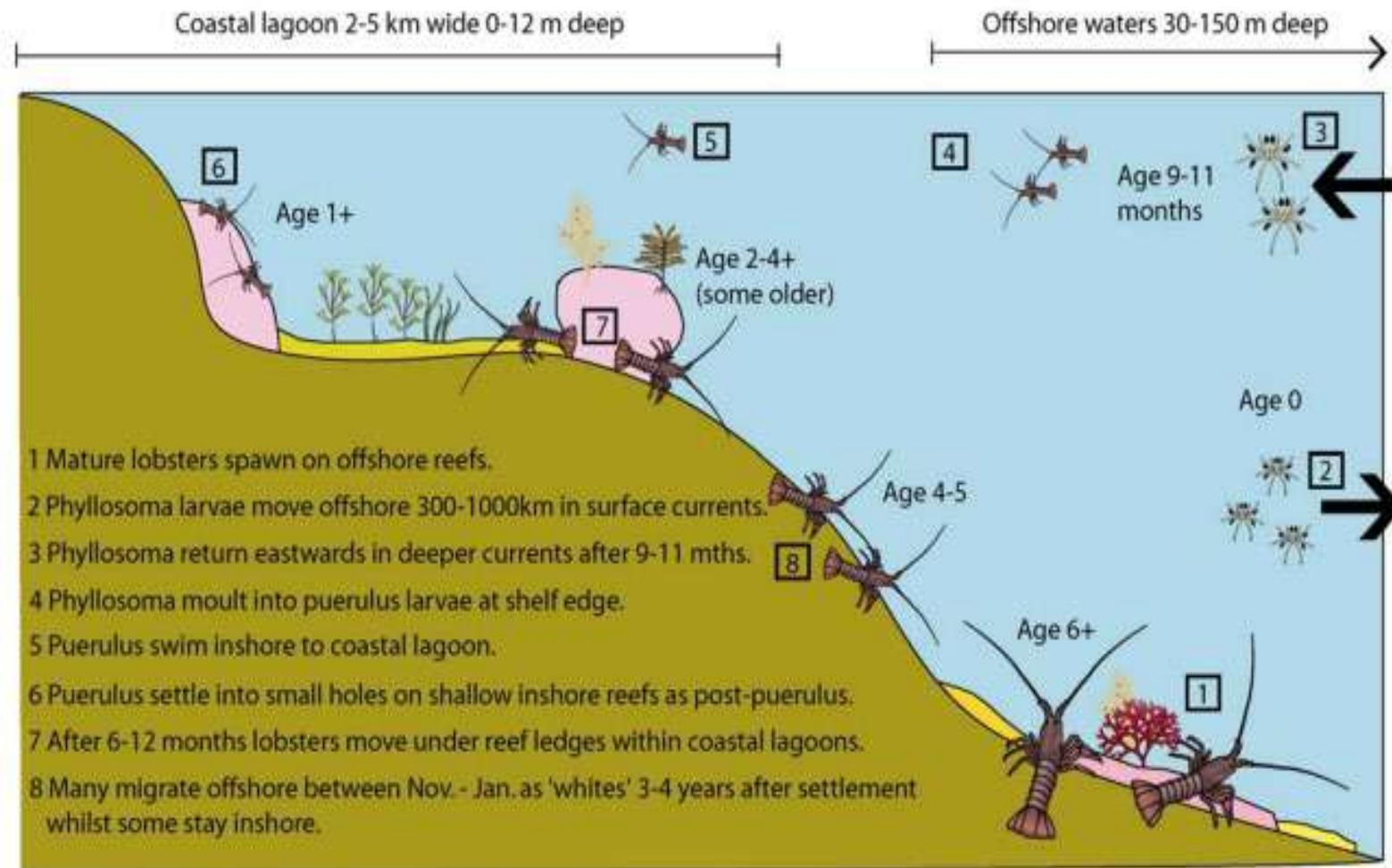


Puerulus Settlement Index



- Also looked at puerulus settlement index for Dongara sector before and after acquisition of Diana 3D MSS
- Period coincides with fishery-wide decline in settlement index 2006-2011

WRL – Peak Periods



- Spawning – Oct to Jan
- Whites migration – Dec to Feb
- Puerulus settlement – Sept to Feb
- Peak fishing – Dec to May

What we've heard (Objections or Claims)	Our view (Assessment of Merit)	Measures adopted because of the consultation
As far as possible, avoid overlap of Eureka 3D MSS and peak periods for key life cycle stages of WRL	Constrained by other seasonal sensitivities – e.g. whale migration; dhufish spawning – and weather.	Our original window was February-March, and we are now looking at August-September as an alternative.

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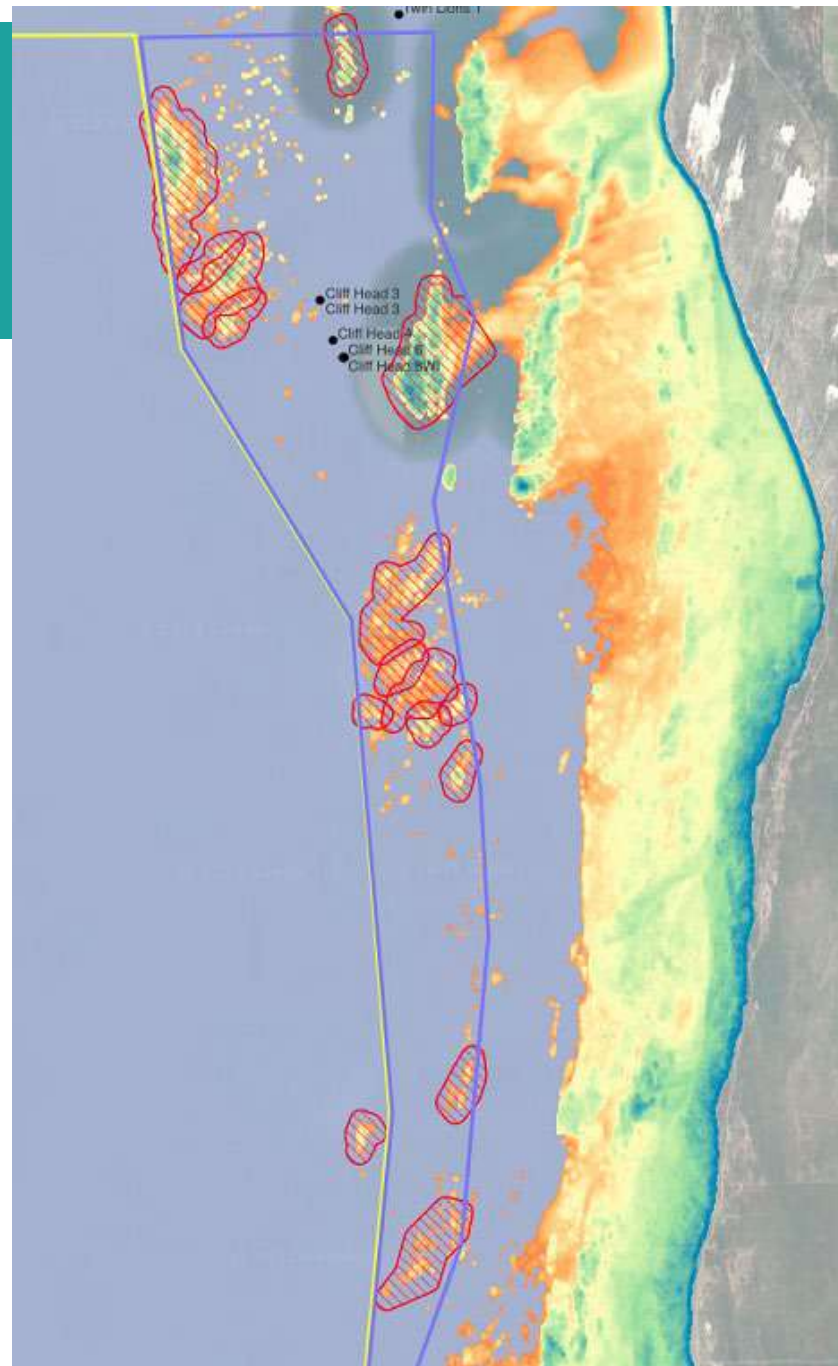
Consultation so far (2)



What we've heard (Objections or Claims)	Our view (Assessment of Merit)	Measures adopted because of the consultation
What are the affects of previous seismic surveys on the Western Rock Lobster fishery.	The Diana 3D MSS is the most relevant survey for comparison and study alongside some relevance of the effects of seismic on Southern Rock Lobster in the Otway region.	Complete and present the findings of the Diana case study review to rock lobster fishers.
Object to the survey entirely.	We have a right to explore for petroleum and we must not interfere to a greater extent than is necessary.	Consult with relevant persons and make efforts to avoid affecting functions, interests, and activities if possible.
If you are going to acquire the survey, minimise your impacts to adult rock lobster.	We understand concerns about the permanent affects or rock lobster agree that our activities could be constrained where abundance of WRL is likely higher, i.e. around reef habitats. We note that the no effect distance ranges from 58m (particle motion threshold) to 292m (sound pressure proxy threshold) from the sound source.	Seismic source will not be operated within 300 m horizontal distance of the 12 m contour around: • Leander Reef • Big Horseshoe Reef, and • 14 other unnamed reef areas within the eastern part of the Active Source Area

Exclusion Zones

- Seismic source will not be operated within 300 m horizontal distance of the 12 m contour around:
 - Leander Reef
 - Big Horseshoe Reef, and
 - 14 other unnamed reef areas within the eastern part of the Active Source Area
- Excises a minimum of 34 sq km from the Active Source Area (~4%)



Consultation so far (3)



What we've heard (Objections or Claims)	Our view (Assessment of Merit)	Measures adopted because of the consultation
Can you reduce the sound levels you require for the survey.	We had previously reduced the source sound as low as we could to meet our geological objectives. Those geological objectives are different in the shallower waters. Source sound levels (and consequently received sound levels) are influenced not only by total capacity (volume) of the array, but also its configuration	Pilot will consider the option of using a smaller seismic source (<2,500 in ³) for acquisition in shallow waters where nodes may be used rather than towed streamers despite the increased cost this would have to the survey.

Consultation so far (4)



What we've heard (Objections or Claims)	Our view (Assessment of Merit)	Measures adopted because of the consultation
Western Rock Lobster are different to Southern Rock Lobster (less robust) and therefore the scientific knowledge of the effects of seismic on Southern Rock Lobster don't apply to Western Rock Lobster.	WRL and SRL will have similarities and differences. The available scientific literature has some relevance and we acknowledge the perception that Pilot Energy may overstate the similarities and/or downplay the differences.	Contacted UTAS to undertake study to evaluate the relevance and transferability of existing scientific knowledge from Southern Rock Lobster to Western Rock Lobster. Currently consulting with DPIRD and UTAS on scope of work. Agreed with WRLC that DPIRD should be involved in the study.
Given the uncertainty of effects to Western Rock Lobster more research should be before (during and after) the survey to understand the effects more.	We can proceed in the presence of some level of uncertainty through management, hence the exclusion zones, and/or through high confidence in our predicted impacts.	Complete independent underwater sound propagation modelling and publish the full report and a summary on the Eureka 3D MSS website and monitor the sound levels emitted to give confidence to the accuracy of our assessment, and hence the assessment outputs.

Consultation so far (5)



What we've heard (Objections or Claims)	Our view (Assessment of Merit)	Measures adopted because of the consultation
We (commercial fishers) will be worse off as a result of not being able to fish, having to fish elsewhere, or damage to our gear. This includes knock-on effects to subsequently displaced fishers and co-ops.	We agree that interference with commercial fishers should be avoided where possible. If this is not possible a compensation protocol should be in place for replacing accidentally damaged or lost gear. Loss of catch in a CPUE adjustment or direct displacement of fishing	We will adopt the NERA Adjustment Protocol as starting point with consultation required to refine content. Purpose of the Adjustment protocol is that no commercial fisher is worse off as a result of the Eureka 3D MSS and that reasonable, evidence-based claims are promptly assessed and resolved.

What happens next?

- Identify yourself in one of the following ways:
 - Relevant person
 - Relevant person represented by consultation with WRLC
 - Relevant persons who opts out of the consultation
 - Interested person who'll participate in public comment
 - Interested person who opts out of the consultation
- As a 'relevant person' you will receive 'sufficient information' for you to make an informed assessment of how your functions, interests, and activities as rock lobster fishers may be affected.
- The Eureka Consultation Team will be in touch with you.

Purpose revisits

- Revisit the purpose of today's session

Provide 'initial information' about the Eureka 3D MSS for you to determine if you are a 'relevant person'.

Provide 'sufficient information' to make an informed assessment of the possible consequences on your functions, interests, and activities.

Understand how to proceed with the consultation process.