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Systematic review of offshore oil and gas decommissioning environmental research in Australia 2016-2025

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Dr Anne Boothroyd lives and works on Muwinina Country. She acknowledges the Muwinina and Palawa peoples as the traditional custodians of the lands on which we work and recognise their continuing connection to land, waters and culture.

The Wilderness Society works across many traditional nations. We pay our respects to elders past and present. We recognise the rights, aspirations and contributions of First Nations' peoples in all aspects of caring for and connection to land, sea and water. We acknowledge that sovereignty was never ceded.

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Executive summary

This paper outlines the results of a literature review of offshore oil and gas decommissioning-related environmental research in Australia. The review assessed Australian offshore oil and gas decommissioning-related studies published in peer reviewed journals over the ten year period from 2016 to 2025. The review included 33 studies which are listed in Table 1.

The findings from this literature review indicate that the environmental decommissioning research undertaken in Australia over the past decade has focused on the potential habitat value of structures left in the marine environment, while research that investigates the risks of in-situ abandonment has been far more limited. The current research agenda is likely shaped by the role of the oil and gas industry as a major funder of decommissioning research.



Research focus for studies:

- 24 of 33 studies focussed on the potential benefits of infrastructure as habitat. These studies covered the potential for infrastructure to support ocean biodiversity, commercial fisheries and ecological connectivity.
- Nine of the 33 studies focussed on the impacts of naturally occurring radioactive materials (NORMs) and other contaminants on marine environments. These studies were not able to assess longer term environmental impacts of NORMs or contaminants.
- Only one study considered invasive species risk when oil and gas structures are left in place, and this wasn't the main focus for the study.

Funding sources for studies:

- 27 of the 33 studies received some or all of their funding from the oil and gas industry. Two of the 33 studies declared funding from undisclosed industry partners. Five studies did not declare any funding sources. One study did not receive industry funding but did receive university funding.
- Industry funders of research include Woodside, Chevron, BHP, ConocoPhillips, Vermillion Oil and Gas, Santos, Esso (ExxonMobil Subsidiary), Cooper Energy (now Amplitude Energy), National Energy Resources Australia, Shell and MMA offshore marine contractors (now Cyan Renewables).
- Other funders included the Australian Institute of Marine Sciences (AIMS), the University of Western Australia, Curtin University, Macquarie University, the Australian Nuclear Science and Technology Organisation (ANSTO), the NetZero Technology Centre and the University of Aberdeen through the UK National Decommissioning Centre, the Scottish Funding Council, the Exmouth Fishing Club, RecFish West, and the Recreational Fishing Initiatives Fund and the Fisheries Division of the Department of Primary Industries and Regional Development of the Western Australian State Government.

The findings from this literature review demonstrate that Australia's offshore oil and gas decommissioning environmental research is currently insufficient to support a thorough environmental risks and benefits assessment of leaving oil and gas infrastructure in the marine environment compared with its full removal.

Introduction

Australian law requires offshore oil and gas infrastructure to be removed from the marine environment when it is no longer in use (Offshore Petroleum and Greenhouse Gas Storage Act 2006, s572(3)).

Oil and gas companies in Australia are currently advocating for permission to leave infrastructure “in-situ” in the marine environment where they can demonstrate it will deliver an equal or better environmental outcome (The Australian, 2026).

It is important to understand the capacity of current Australian literature to support decision making about whether leaving infrastructure in the marine environment would or would not deliver an equal or better environmental outcome. This literature review assesses current Australian offshore oil and gas decommissioning-related environmental research in Australia, to understand the state of current science on this topic in Australia.

Decommissioning-related environmental research within Australia is relatively new, with a limited number of studies to date. The final section in this paper identifies research gaps that would need to be addressed in order to undertake a thorough environmental risks and benefits assessment of leaving oil and gas structures in the marine environment.

Method

The literature review was conducted based on steps 1-10 of the systematic quantitative approach outlined in Pickering & Byrne 2014 (Pickering and Byrne, 2014):

- a. Define topic
- b. Formulate research questions
- c. Identify keywords
- d. Identify and search databases
- e. Read and assess publications
- f. Structure database
- g. Enter first 10 per cent of papers
- h. Test and revise categories
- i. Enter bulk of papers
- j. Produce and review summary tables.

The database search was limited to peer-reviewed scientific journal articles or conference publications within Web of Science, Scopus and Google Scholar databases as these were determined to be the best databases to access peer reviewed scientific journal articles. First, the keywords “Australia AND offshore oil and gas decommissioning” were used to search the Web of Science database. The results were reviewed by reading the title and the abstract to exclude papers not relevant for this study. Studies were excluded from the final sample where they met one or more of the following criteria:

- Published prior to 1 of January 2016 or after 1 January 2026
- Did not investigate environmental impacts of decommissioning
- Only included case study examples outside of Australian waters.

More recent studies that had cited the studies included in the original sample were then identified. Again, the results were reviewed by reading the title and the abstract to exclude studies not relevant for the sample. Next, the same keywords “Australia AND offshore oil and gas decommissioning” were used to search the Scopus and Google Scholar databases. Results were again reviewed by reading the title and the abstract to exclude papers not relevant for the sample.

Each of the studies within the final sample were then read to identify and record the following criteria:

- Date published
- Funding sources for the study
- Geographic location of study
- Focus topic(s) of study.

Other details of interest were also noted such as authors, author affiliations / institutions, findings and recommendations, and the publication journal. Each paper was then categorised according to the above criteria. Analysis was undertaken to identify patterns and relationships.

Findings

The final sample included 33 studies (Table 1).

Funding sources for studies

27 of the 33 studies disclosed industry funding. Two of the 33 studies declared industry funding but did not disclose which industry partners had participated. Where oil and gas industry funding was disclosed, it was provided by Woodside, Chevron and/or the Chevron Technical Centre, BHP, Esso, Cooper Energy, Santos, Vermillion Oil and Gas (Pty) Ltd, and various other operators and industry partners.

Some of the studies that received funding from multiple industry partners received funding from the National Decommissioning Research Initiative (NDRI), which is currently funded by Shell, Esso, Chevron, Woodside, Santos and Vermillion Oil & Gas Australia, and is delivered through the Centre of Decommissioning Australia (CODA). Some studies received funding through the federally funded National Energy Resources Australia funding scheme which was funded until the end of 2023. Seven studies were published in the Australian Energy Producers Journal which is closely associated with and funded by the industry.

Other funders included the Australian Institute of Marine Sciences (AIMS), the University of Western Australia, Curtin University, Macquarie University, the Australian Nuclear Science and Technology Organisation (ANSTO), the NetZero Technology Centre and the University of Aberdeen through the UK National Decommissioning Centre, the Scottish Funding Council, the Exmouth Fishing Club, RecFish West, and the Recreational Fishing Initiatives Fund and the Fisheries Division of the Department of Primary Industries and Regional Development of the Western Australian State Government.

The study published in the journal with the highest impact factor in the sample was published in Nature Scientific Reports (Schramm et al., 2021).

Timing and geographical location of studies

Studies focused on decommissioning from the North West Shelf off the coast of Western Australia, as well as the Bass Strait and Gippsland Basins off the coast of Victoria, or combinations of these locations. This is expected as these are the locations of Australia's offshore oil and gas infrastructure.

Three of the 17 studies focussed on the North West Shelf were funded by Woodside. Other funders of North West Shelf focussed studies were BHP (one study), Vermillion Oil and Gas Australia (Pty) Ltd (two studies), Chevron (two studies), Santos (one study) and the remaining studies funded by a combination of industry operators and partners including Subcon/MMA Offshore marine contractors (now Cyan Renewables) and National Energy Resources Australia.

Studies funded by Woodside were published earlier in the period between 2016 – 2025, with one study published in 2018, one in 2019, and one in 2020. Most studies were published in 2022 (six), 2023 (five) and 2024 (five). Studies focussing on Bass Strait and the Gippsland Basin regions were published later (five studies, one from 2022, two from 2023 and two from 2024). Four of these studies were funded by Esso, and one by Cooper Energy.

Studies on the habitat value of oil and gas structures

24 of 33 studies focussed on the potential benefits of infrastructure as habitat. These studies covered the potential of infrastructure in supporting ocean biodiversity, commercial fisheries and ecological connectivity. All Woodside-funded studies focussed on the benefits of subsea infrastructure, especially pipelines for fish, and the potential value to commercial fisheries where pipelines support habitats for commercially fished species.

Most studies focussed on a select number of commercially fished species (Birt et al., 2024; Bond et al., 2018b; McLean et al., 2020, 2018; Schramm et al., 2021; Sih et al., 2022) and noted limitations in their assessments of how diversity at platforms compared with the ecological values of nearby habitats such as natural reefs. One study noted the limitations in using industry footage for biodiversity assessments where footage was solely provided by the industry (Thomson et al., 2018).

Understanding how offshore oil and gas structures maintain, alter or enhance ecological connectivity is a key research priority (McLean et al., 2022b). However, only three studies in the sample considered the potential role of infrastructure in facilitating ecological connectivity for native species (D'Antonio et al., 2025; Galaiduk et al., 2024; Sobol et al., 2024).

In both the Sobol et al., 2024 and the Galaiduk et al., 2024 studies, natural reefs were found to provide a greater contribution as ecological stepping stones for species connectivity and as larval sources, compared to artificial structures. Both studies noted the potential for artificial structures to enable the spread of invasive species, however this was not the main focus of the studies.

D'Antonio et al., 2025 found that offshore oil and gas platforms had similar effects on the habitat use of whale sharks (*Rhincodon typus*) as naturally occurring geomorphological features such as pinnacles, canyons, and seamounts, particularly where platforms were situated near the continental shelf and other natural geomorphological features. All studies recommended that the role of artificial structures for population connectivity be considered on a case-by-case basis in decommissioning decision-making.

There were no studies with a primary focus on the potential risks posed by structures in facilitating the spread of and hosting invasive species. One of the studies that focussed on ecological connectivity (Galaiduk et al., 2024) did assess whether structures aided the movement of a known marine pest in the region (the invasive long spined sea urchin, *Centrostephanus rodgersii*) with evidence suggesting that structures did not contribute to species movement. However, a recent global review found a greater abundance of invasive species on artificial structures compared to natural reefs (Avila-Turriago et al., 2026).

Studies on the the ecotoxicology of oil and gas structures

Nine of the 33 studies focussed on the impacts of naturally occurring radioactive materials (NORMs) and other contaminants on marine environments. These studies were not able to assess longer term environmental impacts of NORMs or contaminants.

One of the three studies that addressed contaminants found that contamination in sediments surrounding some platforms exceeded reference values and recommended further research (Hook et al., 2023). Two studies found negative impacts associated with concentrated levels of NORMs (MacIntosh et al., 2024; MacIntosh et al., 2023). One study found that diversity in microbial communities decreased when exposed to NORMs (MacIntosh et al., 2024). One study found elevated levels of radioactive materials in benthic organisms exposed to NORM contaminated scale (MacIntosh et al., 2023).



Next steps in addressing the research gaps

Within the international offshore oil and gas decommissioning literature, some studies find that alternative options to full removal may provide environmental benefits with minimal environmental risks, while other studies show that leaving structures in place can pose serious risks to marine environments (Melbourne-Thomas et al., 2021). Most international research is from regions where decommissioning has been underway for decades, such as the Gulf of Mexico and the North Sea, with very different environmental characteristics to Australia.

This review found that most Australian decommissioning-related research from 2016-2025 focuses on the ecological impacts of structures as potential habitats supporting biodiversity, and for supporting stocks of commercially fished species. The review highlights that while there are some studies on the eco-toxicological impacts of oil and gas structures, there are significant gaps in the literature in the understanding of invasive species risks, impacts of contaminants on ecosystems and commercial species, and overall productivity of whole ecosystems (not just for commercially fished species) when oil and gas infrastructure is left in place.

Analysis undertaken by Melbourne-Thomas et al., 2021 shows the areas of further research needed to inform comprehensive environmental values and risk assessments for decommissioning for the Australian context. These are:

- Understanding the long term environmental impacts of contaminants on Australian marine environments. This includes contaminant distribution, persistence and resuspension, and bioaccumulation and sublethal effects from ongoing exposure to Naturally Occurring Radioactive Materials (NORMs) and the potential for oil and gas infrastructure to be active areas for mercury methylation.
- Understanding the ecological impacts of structures as potential habitats supporting biodiversity but also for their potential role in facilitating ecological connectivity, hosting invasive species and influencing overall productivity of systems.
- Understanding the socioeconomic impacts including impacts on fisheries and other ecosystem values and other marine sectors, including impacts of contaminants on these sectors, and understanding values held by Traditional Owner communities and other stakeholders.
- Research that is site specific to address the differences in biodiversity, biological productivity and ocean/climate effects that vary between different locations. For example, assessments of ecological values should be relative to the ecology of nearby habitats such as natural reefs, and risk assessments should assess the risk to seafood contamination at the site and likely risks to the local area from introduced species and other marine pests.

Conclusion

Decommissioning-related environmental research within Australia is relatively new, with a limited number of studies to date. This review of literature from the period 2016 to 2025 found 33 studies.

The review found that environmental decommissioning research undertaken in Australia is largely focused on the potential habitat value of structures left in the marine environment, while research that may expose the risk of in-situ abandonment is far more limited. This review also found the oil and gas industry is a major funder of current research.

The costs of decommissioning are one of the biggest concerns for energy companies and governments globally and in Australia (Goodwin et al., 2017; Li and Hu, 2025). Full removal of infrastructure is the most expensive option, with dismantling and removal of offshore infrastructure approximately 40 per cent of the total decommissioning costs (Janjua and Khan, 2023). Given the likely cost-savings of in-situ decommissioning options, there is an economic incentive for the industry to provide evidence of the environmental benefits of in-situ options such as leave-in-place, partial removal or repurposing.

Further research is needed to inform comprehensive environmental values and risk assessments for decommissioning for the Australian context. It is also important to recognise the role of industry funding and interests in the decommissioning research agenda.

Table 1. All studies categorised by funding source, geographic focus and primary research focus.

				Structures as potential habitats supporting biodiversity: 24*	NORMs: 6	Other contaminants 3
All studies: 33	North West Shelf: 17**	Industry funded: 12	Woodside: 3	³ (Bond et al., 2018a; McLean et al., 2019, 2020)		
			Multiple Industry Partners: 3	³ (Bond et al., 2020; Florisson et al., 2020; Marshall et al., 2025)		
			Chevron: 2	² (Madgett et al., 2023; Schramm et al., 2021)		
			BHP: 1	¹ (Bond et al., 2018b)		
			Vermillion Oil & Gas: 2	² (Tothill et al., 2024; Van Elden et al., 2022)		
			Santos:1	¹ (D'Antonio et al., 2025)		
		No stated funding: 4	No funding sources to declare: 4	⁴ (Sobol et al., 2024; McLean et al., 2017, 2018; Thomson et al., 2018)		
		Other funding sources: 1	Oceanworks ProtoTyping Grant (University of Western Australia): 1	¹ (Thomson et al., 2021)		
	Bass Strait & Gippsland Basin: 5	Industry funded: 5	Esso: 4	³ (Birt et al., 2024; Galaiduk et al., 2024; Sih et al., 2022)		¹ (Hook et al., 2023)
			Cooper Energy: 1	¹ (Ierodionou et al., 2023)		
	Australia (general): 11	Industry funded: 10	Multiple Industry Partners: 6	³ (McLean et al., 2021; Nelson, 2022; McLean et al., 2022a)	¹ (McKay et al., 2020)	² (Cresswell et al., 2021; MacIntosh et al., 2023a)
			BHP: 2		² (MacIntosh et al., 2022a, 2022b)	
			Financial support provided by an undisclosed industry partner: 2		² (MacIntosh et al., 2023b; MacIntosh et al., 2024)	
		No stated funding: 1	No funding sources to declare: 1		¹ (Gissi et al., 2022)	

* The range of benefits discussed includes provision of habitat, supporting commercial fisheries, connectivity for marine mammals, and larval connectivity.

** Two studies focus specifically on King Reef, Exmouth, one study on the Montebello Marine Park, one study on Thevenard Island

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