

## Unforeseen consequences of extractivism: The influence of employment modes and place setting on environmental preferences and values in coastal Australia

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**Document Version:**

Author accepted manuscript (postprint)

**Citation for published version:**

Paterson de Heer, Chloe; Campbell, Marnie L; Rockloff, Susan; Black, Alison L (2017) Unforeseen consequences of extractivism: The influence of employment modes and place setting on environmental preferences and values in coastal Australia. *The Extractive Industries and Society*, Vol. 4, No. 4, pp.875-884. DOI: 10.1016/j.exis.2017.09.004

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**Title:** Unforeseen consequences of extractivism: the influence of employment modes and place setting on environmental preferences and values in coastal Australia.

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## **Abstract**

Many localities in regional Australia have experienced a rapid move from a rural based economy to an extractive one, due to a 'resources boom'. The central aim of this research was to begin to investigate how such rapid industrialisation might influence the relationship between local residents and their environment. A social survey was conducted to investigate if and how environmental values and perceptions are shaped by: a) employment mode (permanent resident or mobile workforce); and b) place setting (urban, rural, or industrial). Surveys occurred in urban, rural and industrial towns in coastal Queensland and South Australia, and tested for landscape preferences and environmental values. Respondents showed a preference for 'naturalistic' coastal landscapes, however respondents that live or work in industrial settings have a greater tolerance for industrial intrusion into the landscape. Industrial workers and residents were less likely to endorse the values of the New Ecological Paradigm. Contrary to public perception, Fly-In Fly-Out workers were more likely than other workers to value the marine environment for its intrinsic worth. Our findings illustrate the complexity of the relationship between industrialisation, employment, and environmental values, and suggest that an industrial place setting, or mode of employment, can erode one's sense of connection to the natural environment.

## **Keywords:**

Environmental Values, FIFO, Industrial Intrusion, Place Attachment, Social Licence to Operate

## 1. Introduction

Understanding the influence of 'place setting' (i.e., a person's home environment) on environmental values and perceptions is vital to how conservation groups advocate for conservation and facilitate the effective delivery of environmental education. A place setting is a socially, culturally, and economically distinct space, and is frequently given as being either rural or urban. Moving away from the rural-urban dichotomy allows for the addition of industrial spaces (highly urbanised) as an emerging place setting descriptor.

Alternate living/working arrangements, such as Fly-In Fly-Out (FIFO) work rosters (also referred to as long-distance commuters and offshore workers), are increasingly common in Australia (Storey, 2010; Joyce et al., 2013), as is moving significant distances away from home for employment opportunities (Petrova and Marinova, 2013). Often this movement is within the context of obtaining work in the resource extractive industries (Storey, 2010; Carrington et al., 2012) and is subsequently linked to poor wellbeing and anti-social behaviours in the new locations (Torkington et al., 2011; Ennis and Finlayson, 2015). These behavioural issues expand to concepts such as littering (Duffy, 2012) and lack of buy-in and awareness of environmental guardianship activities (Campbell et al., 2014). Thus, from conservation and environmental management contexts it is important to gain an understanding of how one's employment mode in a town might influence environmental attitudes and perceptions.

People often have a spatial bias when considering their environment and surroundings: we tend to view proximal conditions more favourably than distal ones (Gifford et al., 2008). This could imply that we strive for a positive place-based identity, and hence we may avoid perceiving negative characteristics of our local environment. If this is the case, then we should see differences in peoples values and perception about their immediate environment based on the period of time a person has resided in an area (which we term 'employment mode').

Within this spatial bias context, it is worth considering how people that have moved to a new location, for work, interact with, or consider the environment. It is important to acknowledge that these individuals may not choose to live in their 'new' locations but have relocated to secure an income for themselves and their family. As such, these individuals may have no affinity for, or particular desire to be at the new location. Therefore, based on the research of Budruk et al. (2011) there is an anticipation that there are differences in the depth of emotional place attachment held by mobile workforces for their temporary location, compared to long term residents. We investigate and discuss whether in such circumstances these individuals interact positively or negatively with the environment; what would drive environmental interactions, and what implications these have for coastal conservation and environmental management.

In an Australian context, the environmental attachment of FIFO and Drive-In Drive-Out (DIDO) workers is of particular interest due to societal concerns (e.g., Torkington et al., 2011; Joyce et al., 2013) and perceived behaviours surrounding this practice. In certain regions of Queensland, a large proportion of the workforce is thought to be comprised of FIFO and DIDO workers. We note however that the Australian census data does not record this type of work status (McKenzie, 2010). An Australian Government inquiry into FIFO workers demonstrated that long-term residents of resource boom communities believe that the presence of FIFO workers results in markedly increased amounts of litter present in an area (Duffy, 2012). Hence, a negative perception exists around the interactions these individuals have with their environment. Yet, this dynamic may be more complex, and perhaps overstated. For example, research by Campbell et al. (2014) contradicts this perception in the Central Queensland region, where there is no statistically significant difference in littering behaviours between local and mobile workforce (including FIFO and DIDO) populations.

The urban/rural divide in terms of environmental experience, knowledge, attitudes and affective connection is well documented (Berenguer et al., 2005; Swanwick, 2009). Hinds and Sparks (2008) assessed numerous elements of environmental affiliation, including affective connection, behavioural intentions, and positive attitudes, and found that rural participants gave significantly higher ratings across these variables than did urban participants. The urban/rural dichotomy is a common topic in the published literature (e.g., Arcury and Christianson, 1993; Berenguer et al., 2005), and the inclusion of industrial place settings in such comparisons is increasingly relevant. Evidence is starting to indicate that industrial settings can negatively influence public perceptions of environmental quality. For example, close proximity to industry can influence people's perception of air-quality (Howel et al., 2002). Similarly, individuals living within view of an open cut mine experience higher levels of 'environmental distress' compared to farmers who lived nearby but had more bucolic views (Higginbotham et al., 2006). Findings such as these highlight the potential social impacts of industrialisation.

Exploring potential differences between industrialised and non-industrialised locations creates opportunities to improve understanding and thus manage environmental conservation targets against the public's expectations and perceptions. As such, the dynamic and complicated relationship that people have with the environment may be better understood within a context that extricates the influence of various demographic and geographical factors (Paterson de Heer, 2015). With this in mind, this research explores how place setting and mode of employment influences marine and coastal environmental values and preferences. This examination occurs in an Australian coastal setting and the findings have the potential to be extrapolated to other industrialised countries.

We hypothesise that affiliation with heavy industry, whether by place setting or mode of employment, will be associated with a reduced:

1. Affiliation with the New Ecological Paradigm; and/or

2. Preference for 'naturalistic' coastal landscapes.

## **2. Methods**

### *2.1 Study sites*

Data was collected through a single, multi-faceted, social survey questionnaire that targeted sites in two states of Australia: Queensland (QLD) and South Australia (SA). The geographical focal point for the research was coastal Queensland, a region where massive industrialisation and resource exploitation are occurring with the concomitant move from a rural based economy to a mining economy (e.g., Cheshire et al., 2014; Windle and Rolfe, 2014). The keystone of the Queensland marine estate is the Great Barrier Reef, which is recognised internationally as a World Heritage Area (Johnston and Smith, 2014). Replicate sites (determined by place setting) were located in South Australia, due to this states historical industrial presence along with its increasing rate of coastal development (Government of South Australia, 2003). There were three study sites in Queensland (Gladstone, Bundaberg, and Brisbane) and three sites in South Australia (Whyalla, Port Lincoln, and Adelaide) (Fig. 1).

Study sites were chosen for their presence in one of the designated states (QLD or SA), proximity to the coastline, and classification as industrial (Gladstone (popln - 63,955) and Whyalla (popln - 22,562)), rural (Bundaberg (popln - 93,976) and Port Lincoln (popln - 14,732)), or urban (Brisbane (popln - 2,308,700) and Adelaide (popln - 1,316,800)), based on sectors of major economic activity (ABS, 2015, 2016). The three place setting classifications covered: light and heavy industry for 'Industrial'; agriculture (e.g., horticulture), forestry, fisheries and manufacturing for 'Rural'; and, construction, manufacturing, and residential services for 'Urban'.

### *2.2 Survey tool*

The sampling frame targeted coastal, Australian adults (>18 years of age), representing a purposive sample of Australian adults living in coastal industrial towns, large coastal rural towns, and coastal urban centres (i.e., capital cities). A quantitative questionnaire was used to collect the data and consisted of closed-ended yes/no (n=4), open ended (n=2) and multiple-choice questions (n=27), including the widely tested New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). Findings reported here represent one segment of a larger research project (Paterson de Heer, 2015) – this article focuses on the NEP scale and marine landscape preferences, stratified by place setting and mode of employment (the questions asked of respondents relevant to this research are provided in Supplementary Material S1). Data was collected via one-on-one, face-to-face interviews that were self-administered. In order to obtain responses from the required sampling frame, the study targeted users of coastal recreational areas, as well as centres of commerce, public libraries and other community hubs, education facilities, and local airports in close proximity to these coastal areas.

At each of the six sites, multiple geographical anchor points were selected for sampling. A randomized pattern of days and times for the various anchor points was enacted to help prevent repetitive sampling of the same portion of the population. Respondents were recruited via a skip-interval method, with every third passer-by offered the opportunity to participate in the survey. However, snowball techniques were applied when recruitment of one participant led to interest in the survey by their companions or other passers-by.

Surveys occurred over a two-week period (14 days) at each study site, in Austral spring and summer 2012 and Austral autumn 2013. The questionnaire was delivered on iPad devices, using the iSurvey software system (<https://www.isurveysoft.com>). Each survey took approximately 18 minutes to complete, with completion times ranging from 5-36 minutes. The question order within the questionnaire was held constant across respondents, but



response variables within questions were randomized to ensure that order bias was addressed. Participation in the survey was voluntary, and responses were anonymous.

The visual component of the survey asked participants to rate a series of landscape images (Supplementary Material Fig. S1) for preference. A shoreline landscape scale was developed, showing increasing industrial development. The degree of development present in the scenes was used as an indicator of people's preferences for human intrusion into the landscape.

To create the landscape images, digital photographs were taken at various sites around metropolitan Adelaide, including beaches, forests and agricultural plots. Images were digitally manipulated to illustrate a 'pristine' (i.e., clean and natural) starting point, from which they were altered to demonstrate stages of industrial development. The subsequent stages of development were achieved by adding layers of additional photographic material that had been masked, transformed, and otherwise manipulated to appear seamless with the background layer. The final images have a surreal photo-collage appearance. The landscape images were designed to be recognisable to participants in terms of their level of development, but not to provoke any feeling of recognition of a specific or real world place.

Descriptive statistics were used to explore the survey population, stratified by place setting (urban, rural, or industrial), and modes of employment grouped as:

- local residents: those that have resided in the area for more than two years;
- itinerant residents: those that have resided in the area for two years or less; or
- transient workers: those that are FIFO or DIDO (grouped separately).

Survey variables were analysed against modes of employment and place setting (urban, rural, or industrial). To test for significant relationships between factors, chi-square ( $\chi^2$ ) tests of independence were conducted using Microsoft Excel. A p value of 0.05 was used for

statistical significance. The New Ecological Paradigm scale was measured for internal consistency using Cronbach's Alpha ( $\alpha$ ).

### **3. Results**

A total of 541 people participated in the surveys (Table 1). Response rates (proportion of those invited to participate that completed the entire questionnaire) varied across the sample sites (Table 1), but fell within the expected range for this type of research (average response rate of 55.6%; Baruch, 1999). We note however, that average response rates are declining over time (Baruch, 1999; Tourangeau and Plewes, 2013).

The generic demographic data collected indicates that the sample group was reasonably representative of the Australian population as a whole. National census data for Australia is not specific to geographical settings, so it is not possible to compare these results with census data about coastal dwelling Australians. However, data from the Australian Bureau of Statistics (ABS) indicate that as of 2001, 85% of Australians lived within 50km of the coast (ABS, 2016). Given the large proportion of Australian residents residing coastally, for the purposes of this research generalised data from the ABS is utilised to determine representativeness of the study sample, despite ABS data not referring exclusively to coastal dwellers.

The survey sample was younger and more highly educated than the general population. A far greater proportion of the survey sample had obtained a bachelor's degree or higher degree (43.2%) compared to the general population (25%). Additionally, a large proportion (40.8%) of survey respondents were born after 1980, whereas only 13.5% of the Australian population falls within this age bracket (Fig. 2). The sample group was also slightly skewed towards female respondents (53.9% versus 50.5% of the Australian population).

The median taxpayer's income at the time of sampling in Australia was \$46,684 (<http://www.abs.gov.au/ausstats/abs@.nsf/mf/6523.0>). While 16% of the sample chose not to disclose their income, 38.9% of the sample earned less than the national median, 17.7% earned above this median, and 27.1% fall into the median category. Thus, this dataset is generally representative of average personal incomes in Australia.

The majority of survey respondents considered themselves to be permanent residents of the towns in which they were surveyed (n=402). Itinerant residents (those who had lived or planned to live in the area for less than two years) (n=66), FIFO workers (n=12) and DIDO workers (n=11) (collectively referred to as mobile workforces) represented small proportions of the sample. Nine percent of respondents (n=50) chose not to disclose their mode of employment. It is difficult to ascertain the representativeness of the sample in regards to employment mode, largely due to the lack of empirical data available about remote working arrangements such as FIFO and DIDO in Australia (House of Representatives Standing Committee on Regional Australia, 2013).

Several of the sampled towns employ a large number of resource workers, and while the resource industry employs upwards of 173,388 people (in 2013-2014) across Australia in mining alone (<http://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/8155.0>), the Australian census does not measure the extent of FIFO/DIDO work practices. Hence, there is a dearth of nationally consistent data on this type of workforce provision (House of Representatives Standing Committee on Regional Australia, 2013). Private surveys indicate that approximately 47% of mining employees are on FIFO contracts and 4.7% on DIDO contracts (Skills Australia, 2005). The Gladstone region expected to have a FIFO/DIDO work population of approximately 7% in 2013 (Government Statistician, 2012), with an anticipated decline after major Liquid Nitrogen Gas plant construction ends. Extractive industries in Australia have been steadily growing over the past decade of the 'resources boom', however the

resource economy is subject to boom/bust cycles, and current figures indicate that this sector is now in decline (Fleming et al., 2015).

The results of the New Ecological Paradigm scale demonstrated good internal consistency ( $\alpha = 0.806$ ), with the correlation between scale items above the required level to indicate a reliable survey instrument (George and Mallery, 2003). The NEP is discussed within the context of modes of employment and place setting further below.

### *3.1 Influence of mode of employment*

There was a statistically significant correlation between employment mode and NEP score ( $\chi^2_{[12]} = 15.2$ ,  $p < 0.05$ ; Fig. 3). All DIDO workers and the majority of permanent residents and itinerant residents had moderately intrinsic NEP scores (Fig. 3). In contrast, the majority of FIFO workers had highly intrinsic NEP scores (Fig. 3). Itinerant workers had a higher level of neutral NEP scores than other employment mode groups (Fig. 3). No respondents from any group demonstrated moderately, or highly, instrumental NEP scores.

A respondent's mode of employment had a statistically significant influence on their preferred beach landscape ( $\chi^2_{[15]} = 38.6$ ,  $p < 0.001$ ; Fig. 4). Regardless of employment mode, the majority of respondents selected the beach scene with mangroves as their favourite image (Fig. 4). Of the employment mode groups, permanent residents and DIDO workers were most likely to select the beach scene with revegetation as their favourite image (Fig. 4). Itinerant residents and FIFO workers were most likely to select the beach scene with high-rise developments as their favourite image (Fig. 4). This indicates a split between a preference for environmental improvement projects, and a preference for improved residential facilities. None of the FIFO or DIDO workers chose the beach scene with a pub and jetty as their favourite image, whereas small proportions of the itinerant workers and permanent residents selected this option (Fig. 4), reflecting a greater preference for recreational/community spaces by those that lived in the area full-time. A very small

proportion of the permanent residents nominated the beach scene with industry as their favourite, and none of the itinerant residents chose this option, whereas larger proportions of the FIFO workers and DIDO workers (e.g., those most likely to benefit from industrial development) chose this as their preferred landscape (Fig. 4).

### *3.2 Influence of place setting*

There was a significant correlation between place setting and NEP score ( $\chi^2_{[6]} = 15.86$ ,  $p < 0.05$ ; Fig. 5). There was an overall pattern towards rural and urban respondents demonstrating more intrinsic ecological value orientations than industrial respondents (Fig. 5). The industrial respondents were the only group for whom a small proportion of respondents (2%) demonstrated a moderately instrumental value orientation.

There was a significant correlation between place setting and preferred coastal landscape ( $\chi^2_{[10]} = 22.92$ ,  $p < 0.05$ ; Fig. 6). All place setting groups showed a preference for 'naturalistic' images (i.e., mangroves and revegetation landscapes), however the urban respondents were more likely to select the mangrove image (i.e., the 'pristine' scene) as their preferred landscape, followed by rural and then industrial respondents (Fig. 6). The rural and industrial groups showed a greater preference for the revegetation image than did the urban group (Fig. 6). The industrial group showed an elevated preference for the high-rise development image, relative to the other two residence groups (Fig. 6).

## **4. Discussion**

In the modern Australian workforce there are numerous modes of employment that may directly influence workers personal geographies and relationships with their home and work environments. The increasing prevalence of transient work modes, and the necessity of employee flexibility regarding work location has meant that Australia hosts a significant itinerant and DIDO and FIFO workforce (Martin, 2012; McIntosh, 2012). By examining

differences between permanent residents, itinerant residents, FIFO and DIDO workers, we have attempted to investigate whether perceptions and values towards the marine environment may be shaped by the relationship one has with a town in terms of mode of employment (e.g., long term resident, recent arrival, transient worker). Although we have focussed upon Australia, we note that FIFO and itinerant work rosters are common in other countries, such as Canada (e.g., Bowes-Lyon and Richards, 2009; Ryser et al., 2016; Vodden and Hall, 2016), Russia (e.g., Saxinger, 2016; Saxinger et al., 2016), the United Kingdom (e.g., Parkes et al., 2005) and African nations (e.g., Chatiza et al., 2015). Therefore, the implications of our findings are applicable beyond Australian shores.

As a second driver in our research, we have examined differences between those living in urban, rural, and industrial settings, to explore the socio-environmental ramifications of place setting during adulthood. Whilst the majority of Australians live near the coast, the vast distances and small population of the country have allowed for various place settings to persist without becoming enveloped by urban sprawl. The Australian coastline encompasses large capital cities as well as vast tracts of largely agricultural land and a rapidly increasing number of ports and industrial hubs. We believe that the primary economic drivers of a town can influence the environmental experiences of its inhabitants through land use decisions, employment prospects, impact on environmental quality, and scenic amenity. This relationship was examined further in our study.

#### *4.1 NEP Score*

We hypothesised that affiliation with heavy industry, whether by place setting or mode of employment, would be associated with a more instrumental valuation of the natural environment (reduced affiliation with the NEP). Such a utilitarian connection is often linked to extractivism (Acosta, 2013), and has been argued as a mechanism to empower indigenous communities if they embrace this approach to commodify their owned resources (e.g.,

Stammler and Ivanova, 2016; Wilson and Stammler, 2016). The results regarding modes of employment did not support our hypothesis – in fact, FIFO workers demonstrated an elevated affiliation with the NEP, and hence were focussed more upon a balance between the environment, social issues, and resource use.

The Australian economy has been influenced by the mining boom (e.g., Downes et al., 2014). Mining is an established extractive industry that does not favour conservation or maintaining intact land (or sea) areas, but takes a resource conservation ethic approach of “use it or lose it” (e.g., Campbell, 1998). The influence of the mining industry in Australia suggested that we would detect an associated extractivism approach (utilitarianism) from FIFOs and itinerant workers. Yet, this was not the case (Fig. 3). Instead, the survey respondents tended to have an intrinsic approach (Fig. 3). ‘Social licence to operate’ (SLO) may have an influence here.

Social licence to operate theorizes that all parties benefit from an activity, such as resource extraction (e.g., Boutilier and Thomson, 2011; Wilson, 2016), with mutual trust between all parties as an integral component (e.g., Boutilier and Thomson, 2011; Moffat and Zhang, 2014). Therefore, we postulate that for FIFO/DIDO and itinerant respondents, the intrinsic approach that they demonstrated may be related to the concept of SLO. In this instance, these respondents may have perceived that the benefits they received (economic legitimacy) could be attributed to an industry “looking after the region” (socio-political legitimacy and interactional trust) and also considered stakeholders views and needs (institutionalised trust) (e.g., Boutilier and Thomson, 2011). Thus, our respondents may have been exposed to an “effective” SLO and hence, their views were intrinsic in focus.

However, when results were stratified according to place setting (urban, rural, or industrial), our hypothesis that industrialisation might foster instrumental values was only partially supported – the industrial place setting was the only study site in which some respondents demonstrated an instrumental value system (Fig. 5). Environmental value

orientations of industrial residents have been a topic of increasing emphasis in the literature (e.g., Ryser et al., 2016; Stammer and Ivanova, 2016; Saxinger, 2016). The 'extractive commodity hypothesis' posits that those whose livelihood depends on resource extraction are more likely to value the continuation of these industries over environmental concerns (Jones et al., 2003; Huddart-Kennedy et al., 2009a). This theory fits the outcomes from the industrial study sites of this research (Whyalla and Gladstone): both having a large proportion of the population that is directly reliant on extractive industries for their livelihood, which has occurred in some cases over multiple generations.

The various employment mode groups assessed in this study had relatively disparate NEP score patterns (Fig. 3). For example, the FIFO group overall tested higher for intrinsic values than any of the other employment mode group: a finding that is thought-provoking in light of the arguably environmentally destructive basis of the majority of FIFO jobs (McKenzie, 2011). This may be a reflection of an effective SLO within the mining sector in Australia. Regardless of the debate about its ecological sustainability, the resources industry is undeniably structured around an instrumental attitude towards the environment. Hence, the fact that the FIFO respondents in this study did not share this value orientation is intriguing and requires further follow-up.

This value-orientation may be explained by Ripley and Redmann (1995) who noted that there is a growing public appreciation of the natural environment and awareness of the environmental impacts of mining within the mining sector. The industry now operates in a more regulated and competitive environment, where its environmental performance is held to account and hence it has developed mechanisms to achieve SLO. Unfortunately, we did not anticipate an influence of SLO and consequently did not measure this factor but we feel that the four facets of SLO that Boutilier and Thomson (2011) have put forth may be an ideal way to measure this influence alongside a NEP analysis.



Previous studies have demonstrated that witnessing environmental degradation firsthand can result in stronger pro-environmental attitudes, so long as those in question have a basis for comparison with less degraded environmental contexts (e.g., Swan, 1970; Chawla, 1988). Australian FIFO and DIDO workers may indeed have this comparison, as long-distance commuters that live elsewhere and commute to an industrial area for work that may not strictly be of their choosing (i.e., they go where the work is). Furthermore, direct experience with an object (in this case, degraded environments), has been shown to elicit stronger attitudinal responses than indirect experience (Fazio and Zanna, 1981). Such findings contribute to a theoretical framework to help to explain the enhanced biospheric values of resource workers, as seen in this research.

Respondents living in the three different place settings (urban, rural, industrial) showed significant differences in their NEP scores. Overall, rural respondents showed the most intrinsic NEP scores, followed by urban and then industrial respondents. The industrial place setting was the only setting where some of the respondents demonstrated an instrumental value system (Fig. 5). This finding is contrary to much of the earlier work on environmental value orientations across different place settings, which indicate that rural residents generally have less of a biospheric leaning than urban residents (e.g., Arcury and Christianson, 1993).

More specifically, Berenguer et al. (2005) demonstrate that urban respondents NEP scores are higher for environmental concern than rural respondents: a finding that is weakly supported by the results of this study (Fig. 5). However, both groups demonstrated a similar pattern of NEP scores that were more intrinsic than those of the industrial respondents. What we may be witnessing is the historic urban/rural divide in environmental values closing, as more environmentally minded 'urbanites' migrate to the countryside, and as access to education becomes more equitable between the two place settings (e.g., Emmett-Jones et al., 2003).

#### 4.2 Preferred 'Naturalistic' Landscape

We hypothesised that those in alternative working arrangements, and living in industrial towns, would demonstrate a reduced preference for 'naturalistic' landscapes. Our results lend some support to this hypothesis.

Across employment modes, preference for the mangrove landscape (i.e., 'pristine' landscape) was fairly consistent (Fig. 3). This provides further evidence for a somewhat universal preference for 'natural' landscapes (c.f. Ode et al., 2009). Industrial beachscape were rarely selected by permanent and itinerant residents. Conversely, FIFO and DIDO workers were more likely to select this beachscape as their favourite – albeit in small proportions (Fig. 3). It is possible that due to their heightened exposure to industrial infrastructure these workers have an increased tolerance for industrial intrusion into the landscape (e.g., the Shifting Baseline Syndrome hypothesis – see Pauly, 1995; Kahn et al., 2008).

Whether the industrial beachscape is preferred on aesthetic grounds is not determined by this study, however it may be that those who chose this as their preferred scene were selecting the image on the basis of the economic and employment opportunities that such infrastructure represents. This would reinforce an economic legitimacy of the industrial intrusion. There is evidence that some people do not respond to natural landscapes (e.g., Van den Berg and Van Winsum-Westra, 2010), which is supported to some extent in this study by the proportion of respondents that selected the industrial, high rise, or rock wall and houses landscapes as their preferred scenes (Fig. 3).

There were significant differences in beach landscape preferences amongst the three place setting groups (Fig. 6). All respondents demonstrated an overarching preference for naturalistic place settings. However, urban respondents showed an elevated preference for the mangrove image, whereas rural and industrial respondents preferred the revegetation

image. Furthermore, industrial respondents demonstrated a slightly elevated preference for the high-rise image as compared to the rural and urban respondents. That urban respondents preferred the 'wilder' mangrove image contrasts with the dominant beach landscape type found in the urban study sites – that of cleared, built-up, metropolitan beaches. Preference for mangroves may be due to mangrove systems being representative of natural productive habitats for fish and crabs in Australia, in contrast to the recreational value of beaches.

It is possible that having experienced the loss of this habitat type, urban residents are more able to perceive its value and thus prefer it to the landscapes that more closely resemble their local beaches. There is generally a greater contemporary conflict in terms of land-use in rural and industrial areas, which could translate into an acceptance by residents in these regions that coastal land must be cleared. Franzen and Meyer (2010) suggest that an individual's environmental concern only appears to translate into pro-environmental behaviour in cases where the behaviour is not cost-intensive.

Relinquishing valuable industrial or agricultural land to wild nature may represent an economic cost to rural and industrial communities. For urban residents, coastal environments are more likely to represent areas of commerce and recreation, needs perhaps more easily balanced with habitat preservation. There is also a stigma surrounding 'swamp' environments such as mangroves (e.g., Duke, 2006), in particular that they attract insects. This perception would be a particular deterrent for rural residents whose livelihood depends on agricultural activities. Pastoralists also have a more intensive 'stewardship' role with the natural environment (e.g., Gill, 2014), which may shape their desire for tidier, more human-mediated landscapes such as the revegetation image – symbolic of either active management or rehabilitation activities.

In terms of the elevated preference for the high-rise landscape amongst industrial respondents (Fig. 6), it is possible that the emphasis of the resource industry on upward

mobility and human-built amenity may in some way be shaping the preferences of workers. Further work is required to thoroughly evaluate the goals and preferences of industry workers, given that they are a moderate component of the Australian workforce and those overseas.

#### *4.3 Implications for conservation and environmental management*

There is an unequivocal relationship between time spent in nature and environmental stewardship (e.g., Mayer and Frantz, 2004). Amongst adults, a sense of interconnectedness with nature has been found to be correlated with pro-environmental attitudes and behaviours (Hoot and Friedman, 2011). This study provides further evidence for the link between exposure to healthy ecosystems and the perception of the environment as intrinsically valuable. Survey respondents demonstrated varying levels of affiliation with biospheric values depending on the type of environment in which they lived, with rural environments best fostering these values, followed by urban, and finally industrial place settings.

This relationship between person and environment is sometimes operationalised as place attachment (i.e., a bond between a person and a place), which is built upon through a history of involvement or residence in that specific place (Hidalgo and Hernandez, 2001). Place attachment to the natural environment has been shown to foster protective feelings (Scannel and Gifford, 2013), as well as environmentally responsible behaviour (Vaske and Kobrin, 2001). The flipside of this positive relationship between direct experience and degree of connectedness is the impact that a paucity of environmental experience can have. The results of this survey indicate that those with the greatest personal investment in a region (e.g., permanent residents and those likely to live nearby, such as DIDO workers), are most likely to show preference for landscape revegetation, indicating support for efforts to improve and rehabilitate the local environment. This preference may be a reflection that

permanent residents are more likely to be aware of environmental programs in their region (Campbell et al., 2014). In contrast, more transient residents ascribed a greater preference to high-rise development; a form of construction which physically isolates occupants from the surrounding coastal environment.

It is theorised that people need experiences of non-degraded nature not only to develop an ethic of care, but also to obtain the perceptual baselines required to perceive environmental change. Likewise, Pyle (1978) suggests that an extinction of experience (of the natural world) “*creates a cycle of disaffection, apathy and irresponsibility*”. From this perspective, it is essential that both adults and children have the opportunity to experience, in fact to know deeply, their local marine and coastal environments. This knowledge and connection is required both to foster a relationship of stewardship, and to equip citizens with the required environmental benchmarks to recognise and react to rapid or deleterious environmental change (Seppelt and Cumming, 2016).

The enhanced environmental outcomes of a pro-conservation population are abundantly clear. Human beings derive broad, tangible benefits from experiencing a healthy natural environment (Shanahan et al., 2016). Ample evidence can be found in the literature for the various ways in which nature, specifically ‘blue’ nature, can enhance human well-being, both physical and psychological (e.g., Volker and Kistemann, 2011, Nutsford et al., 2016; Foley, 2017). In addition to the many global ecosystem services provided to humans by the marine environment (e.g., climate mediation, global water cycling, food), access to the ocean and coast has been shown to enrich physical health on local and population levels. Bathing in the sea (thalassotherapy) has been prescribed to treat medical ailments since the time of the ancient Greeks (Van Tubergen and Van der Linden, 2002). Across cultures and timescales, the ocean is consistently considered to be a “*therapeutic landscape*” (Foley, 2010). In a contemporary context in the United Kingdom, after controlling for demographic and lifestyle variables, self-reported good health has been found to be higher in

communities closer to the coast (Wheeler et al., 2012). This finding was supported by further work in the same area, which found that both general and mental health was higher in individuals of greater coastal proximity (White et al., 2013).

The specific mechanisms by which coastal living promotes health have been subject to some investigation; with a number of papers suggesting that the facilitation of physical activity is likely to be the key agent (Ashbulby et al., 2013). The flow-on effects of physical activity include stress reduction and increased social interaction, which are also likely to contribute to enhanced physical well-being (Maas et al., 2009). Water is considered to have a greater positive impact on mental state than other elements (Felsten, 2009). Stress reduction and psychological restoration are two of the key benefits of access to the marine environment (White et al., 2013; Marselle et al., 2013). Blue spaces (even just images of these) have been found to reduce stress and enhance mood (Karmanov and Hamel, 2008), increase interest and attention (White et al., 2010; Volker and Kistemann, 2011), and help attenuate noise annoyance (Li et al., 2012). Likewise, walking in coastal environments results in greater feelings of restoration, greater improvements in self-esteem, and has a greater mood enhancement effect than walking in urban or rural greenspace (Marselle et al., 2013).

These findings may have particular relevance to industrialising regions of Australia, as workers in the resource extraction sector have been found to be more likely to smoke, drink alcohol to risky levels, and be obese compared to the general population (Joyce et al., 2013). Similarly, these workers work irregular hours, experience poor quality of sleep, and experience isolation and depression (Clifford, 2010; Carrington and McIntosh, 2013). Targeted efforts to engage transient and FIFO/DIDO workers with the local marine environment has the potential to encourage health-promoting activities amongst this sector of the workforce, in addition to enhancing buy-in for marine conservation.

## **5. Conclusion**

The results of this study suggest that an industrial place setting or mode of employment can erode one's sense of connection to the natural environment. Our results indicate that those who live, or work, in industrial settings are more likely to prefer high-rise development at the coast rather than natural landscapes. Similarly, industrial workers and residents demonstrated less affiliation with the values of the New Ecological Paradigm. These results are of particular concern giving the ongoing industrialisation of much of Australia's coastline. We feel that this disconnection between residents and their local marine environment will be detrimental to sustainability, particularly ecological outcomes and human flourishing.

#### **Acknowledgements:**

We would like to thank and acknowledge the participants in the questionnaire surveys. Prior to any survey work being conducted ethics approval was obtained from Central Queensland University Human Research Ethics Committee (Queensland) (project H12/08-164). This work was partially funded by grants to CPdH from the CQUniversity Vice Chancellor's Excellence in Research Award and industry funding from the Queensland Gas Company (QGC), through Conservation Volunteers Australia. The funding agencies had no such involvement in study design, collection, analysis and interpretation of data, writing our manuscript or the decision to submit this article for publication. We thank Daniel Harkin for developing the photographic images used for this study. We thank Ross Martin for creating Fig. 1.

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## Figure captions

Fig. 1. Location of rural, industrial and urban sites sampled in Queensland and South Australia

Fig. 2. Respondent characteristics across all six study sites

Fig. 3. Influence of residency status on New Ecological Paradigm score. Purple denotes permanent residency status; blue denotes itinerant residency status; orange denotes Fly-In Fly-Out residency status; and green denotes Drive-In Drive-Out residency status

Fig. 4. Influence of residency status on preferred landscape imagery. Purple denotes permanent residency status; blue denotes itinerant residency status; orange denotes Fly-In Fly-Out residency status; and green denotes Drive-In Drive-Out residency status

Fig. 5. Influence of adult place setting on New Ecological Paradigm score. Purple denotes urban sample location; blue denotes rural sample locations; and orange denotes industrial sample locations

Fig. 6. Influence of adult place setting on preferred beach landscape. Purple denotes urban sample location; blue denotes rural sample locations; and orange denotes industrial sample locations

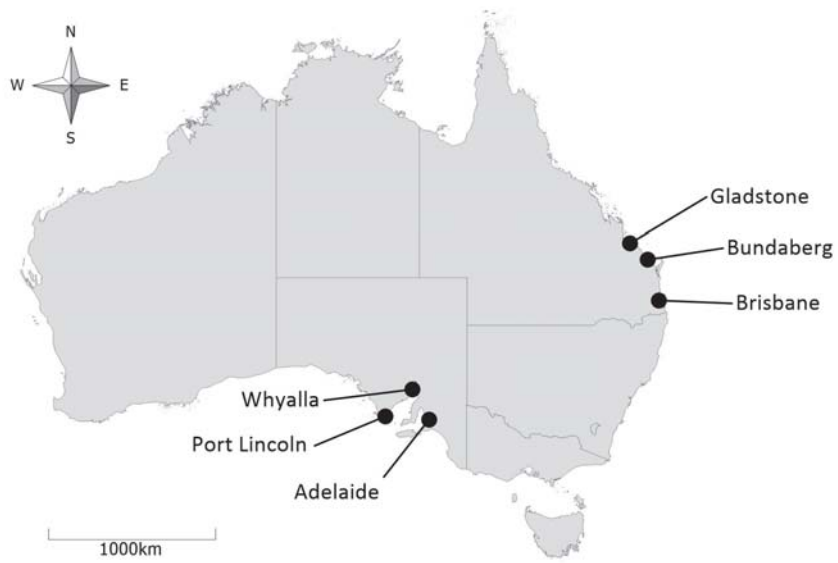


Fig. 1

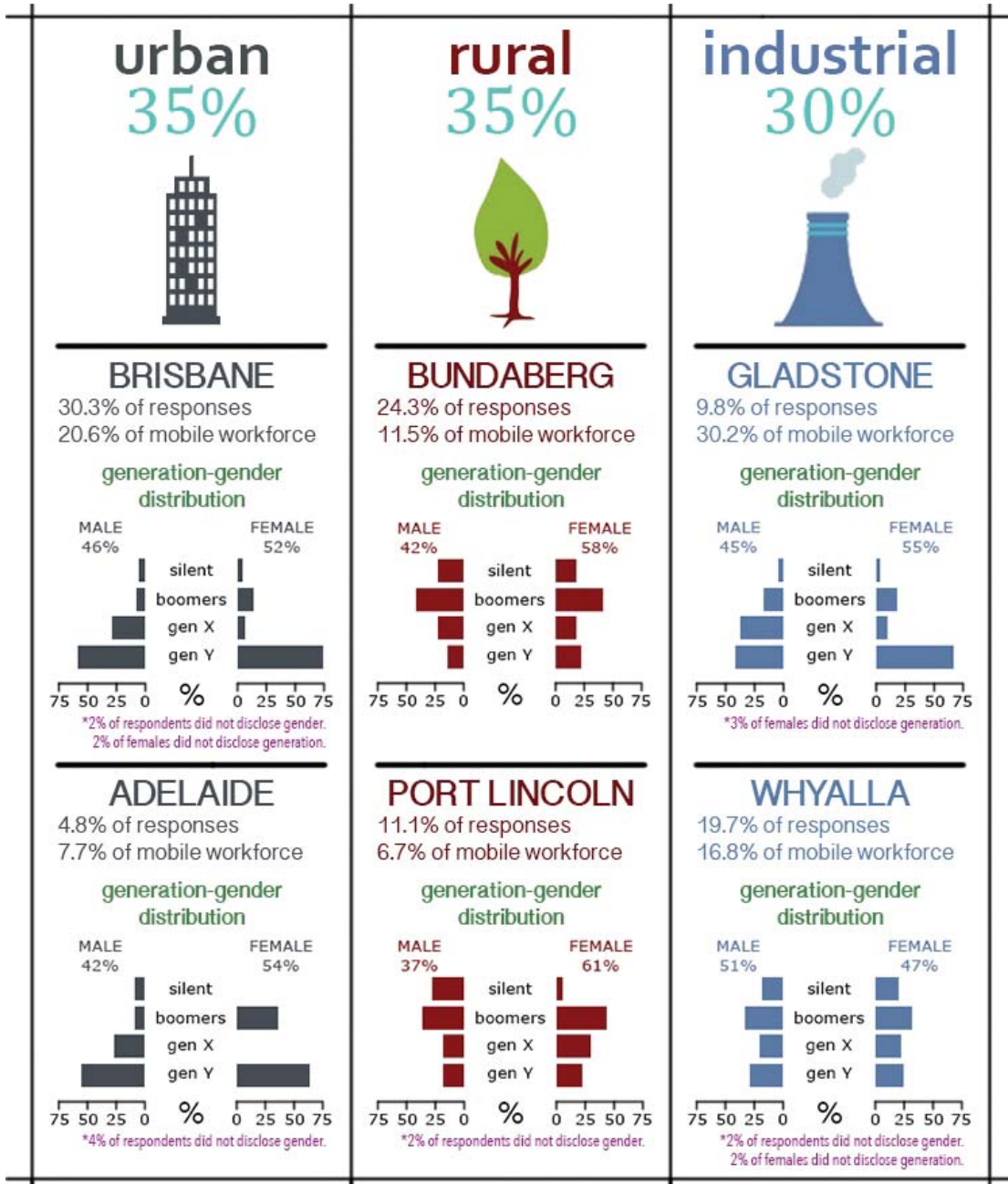


Fig. 2

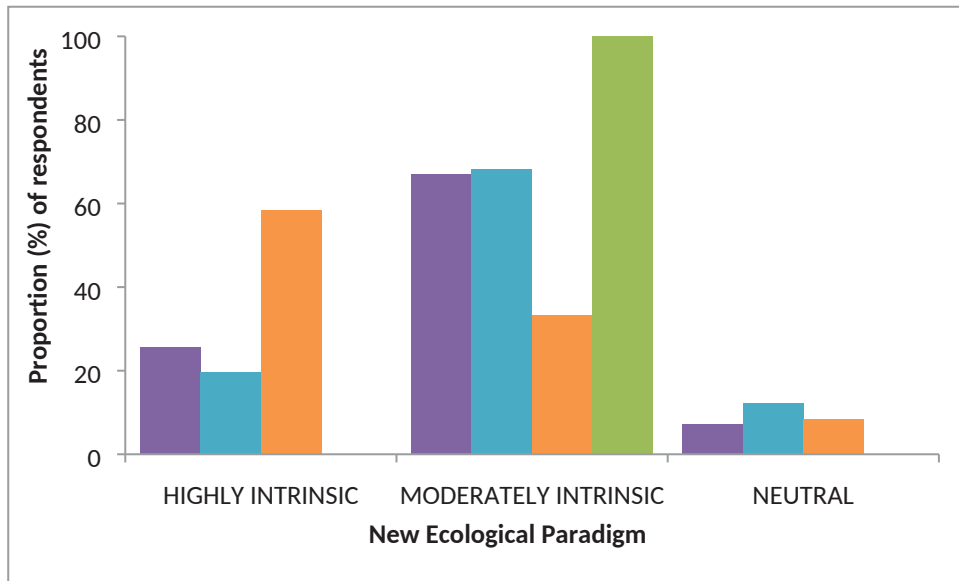


Fig. 3

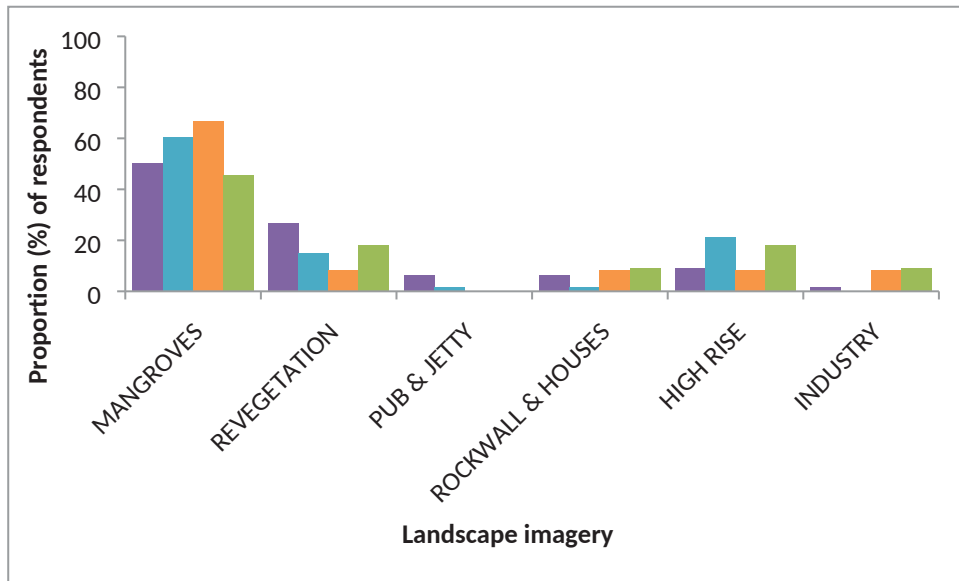


Fig. 4

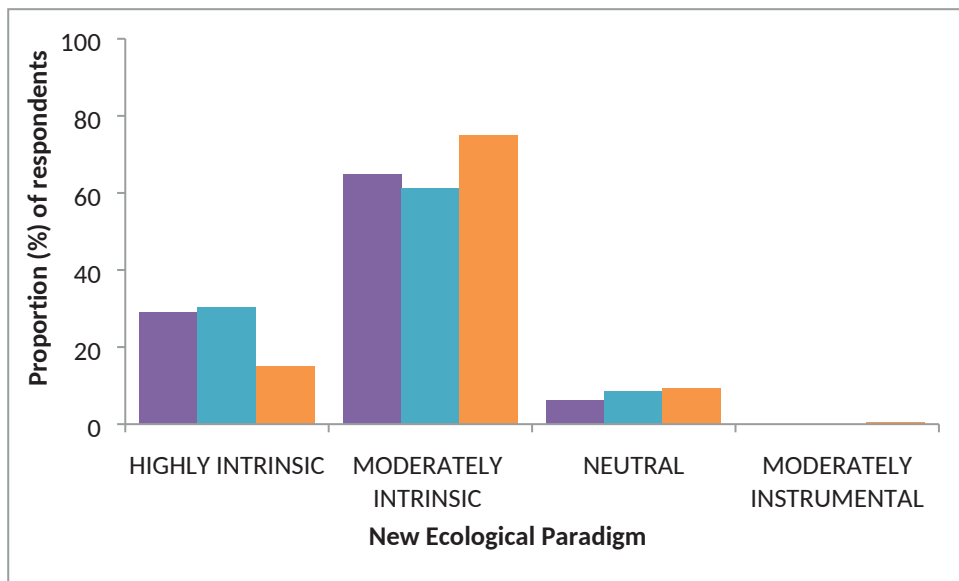


Fig. 5

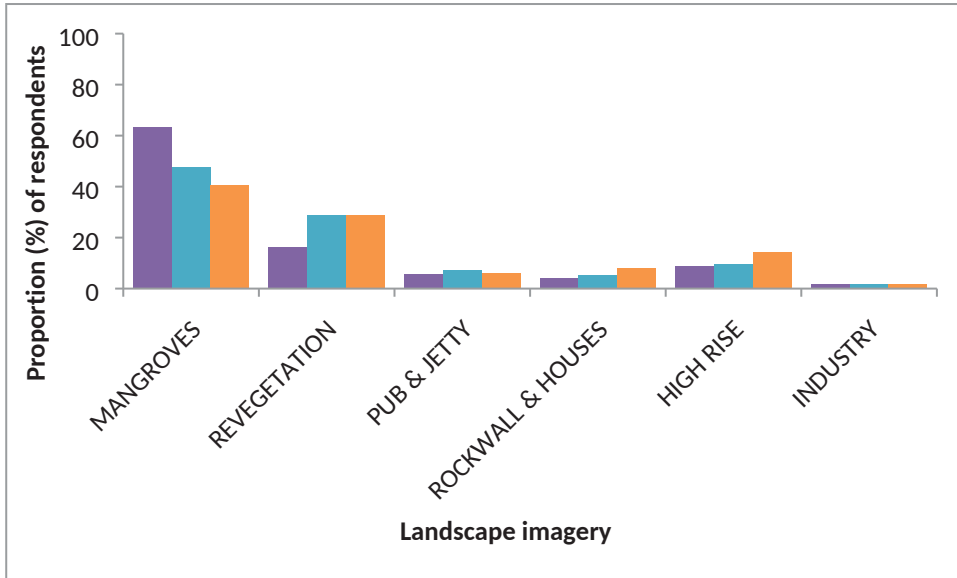


Figure 6



**Fig. S1:** Coastal development image series. Images S1a to S1f denote coastal environment transitioning from 'pristine' to 'industrial' scenes. Each image along the transition represents further human intrusion into the landscape.



Fig. S1a



Fig. S1b



Fig. S1c



Fig. S1d



Fig. S1e



Fig. S1f

**Table 1:** Questionnaire response rates by location and residency status type

<b>Site</b>	<b>Response Number</b>	<b>Response Rate</b>	<b>Residency Status Distribution</b>
<i>Queensland</i>			
Gladstone	53	58%	Permanent (58.5%), itinerant (26.4%), DIDO (3.8%), none (11.3%)
Bundaberg	131	53%	Permanent (80.1%), itinerant (9.2%), FIFO (0.8%), DIDO (1.5%), none (8.4%)
Brisbane	164	62%	Permanent (70.8%), itinerant (15.8%), FIFO (3.6%), DIDO (1.2%), none (8.6%)
<i>South Australia</i>			
Whyalla	107	64%	Permanent (67.3%), itinerant (9.3%), FIFO (2.8%), DIDO (4.7%), none (15.9%)
Port Lincoln	60	47%	Permanent (90%), itinerant (6.7%), none (3.3%)
Adelaide	26	49%	Permanent (92.3%), FIFO (7.7%)