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Littering dynamics in a coastal industrial setting: The influence of non-resident populations

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ABSTRACT

We examined if there is truth to the preconceptions that non-resident workers (including FIFO/DIDO's) detract from communities. We used marine debris to test this, specifically focussing on littering behaviour and evidence of awareness of local environmental programs that focus on marine debris. Littering was most common at recreational areas, then beaches and whilst boating. Twenty-five percent of respondents that admit to littering, reported no associated guilt with their actions. Younger respondents litter more frequently. Thus, non-resident workers litter at the same rate as permanent residents, visitors and tourists in this region, within this study. Few respondents are aware of the environmental programs that operate in their local region. Awareness was influenced by a respondent's residency (non-residents are less aware), age, and level of education. To address this failure we recommend that industries, that use non-resident workers, should develop inductions that expose new workers to the environmental programs in their region.

1. Introduction

Marine debris is a ubiquitous problem that is fundamentally linked to people's littering behaviour, whether intentional or unintentional (Benton, 1995; UNEP, 2005; Santos et al., 2009; Slavin et al., 2012). It is present on our beaches and in our oceans and causes numerous environmental, aesthetic, economic and health problems to those that are exposed to it, including humans (Whiting, 1998; Abu-Hilal and Al-Najjar, 2004; Ivar do Sul and Costa, 2007; Clark, 2008; Williams et al., 2013; Campbell et al., in review), birds, fish, invertebrates, and marine megafauna (e.g., Bjorndal et al., 1994; Frost and Cullen, 1997; Arafat et al., 2007; Sheavely and Register, 2007; Gregory, 2009). This is a problem that has severe environmental impacts but the foundation of the issue is social and hence the solution also has a social foundation.

An important first step in understanding the social dimensions of why marine debris occurs is to understand the prevalence of littering behaviours in regions associated or linked to the marine environment (e.g., beaches, while boating and in coastal recreational areas), the amount of guilt associated with littering (e.g., to understanding what people think about littering) and to gauge the effectiveness of programs associated with combatting the issue. National litter surveys by Keep Australia Beautiful have indicated that industrial areas in Australia tend to have a high level of litter (kab.org.au/litter-research/national-litter-index-2/). Therefore, we selected a small (<60,000 population), regional (i.e., rural), coastal industrial city to undertake a preliminary study towards understanding the social drivers that lead to littering and the local community's knowledge of environmental programs aimed at reducing marine debris. The study site was in Gladstone, in central Queensland, Australia.

The iconic Great Barrier Reef is located offshore from Gladstone. The region holds environmental significance for all Australians (including the locals) and at an international scale. This is illustrated by the offshore regions having three recognised protected areas: (1) the Great Barrier Reef Marine Protected Area (http://www.gbrmpa.gov.au/); (2) the Great Barrier Reef World Heritage Area (http://www.environment.gov.au/heritage/places/world/great-barrier-reef/), which encompasses the port of Gladstone; and (3) a portion of the Great Barrier Reef Particularly Sensitive Sea Area (http://www.imo.org/OurWork/Environment/PollutionPrevention/PSSAs/Pages/Default.aspx). Juxtaposed against these protected areas is the fact that Gladstone is a coastal industrial city with 16 engineering, construction and manufacturing industries and includes the fifth largest multi-commodity port in Australia. A small proportion (~7% in 2013; Government Statistician, 2012) of the population are non-resident workers.

Non-resident workers include non-resident fly-in/fly-out [FIFO], non-resident drive-in/drive-out [DIDO], and workers that plan to live in Gladstone for less than two years. Much like tourists (e.g., Davenport and Davenport, 2006; Brown et al., 2010), non-resident

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workers are typically described as lacking a connection to place in their community (e.g., Nelson and Hiemstra, 2008), which leads to criticisms about their anti-social behaviours such as littering, violence, promiscuity, and sexism (e.g., Pirotta, 2009; Carrington et al., 2010, 2012; Scott et al., 2011, 2012) and their care for the environment (e.g., Brandenburg and Carroll, 1995). These behaviours are used to question whether the industries that use these workers are operating effectively within their Social Licence to Operate (SLO) (e.g., Gunningham et al., 2006; Nelsen, 2006), or being socially responsible (e.g., Jenkins and Yakovleva, 2006). There is a general recognition that industries need to gain and maintain the support of the communities via meeting societal expectations within the regions they are working and the areas where they have influence (Gunningham et al., 2006).

The evidence for some of these criticised behaviours, such as littering, is limited within the published literature (except see Pirotta, 2009; Carrington et al., 2010, 2012; Scott et al., 2011, 2012). Hence, this paper examines if non-resident workers add to the marine debris issues via littering and a lack of awareness of marine debris awareness programs that occur in the Gladstone region.

2. Methods

A social survey (questionnaire) was developed and implemented to investigate the prevalence of littering in the Gladstone region and to gauge the public's level of awareness of programs aimed at reducing littering. The questionnaire consisted of five components:

- Respondents littering behaviours.
- Respondent's guilt associated with their littering behaviours.
- Respondents demographic information.
  - o Their residency (permanent, itinerant, fly-in fly-out (FIFO), drive-in drive-out (DIDO), other).
  - o Age (>18 years of age).
  - o Gender.
  - o Highest level of education attained.
  - o Annual income.
- Respondents perceptions of what the main source of litter is at beaches.
- Baseline information about respondent's awareness of the Gladstone Harbour Initiatives (four environmental programs).

The sampling frame targeted people in the Gladstone region and occurred over the Austral spring to late summer period (September–February). A skip-interval method was used that selected every second person that walked past the interviewers anchor point (Gladstone Marina Precinct) to participate in the surveys. A shuffle strategy for the order of questions and answer options on the questionnaire was used to ensure that order bias did not occur.

2.1. Statistical analyses

The survey data was analysed using chi-square (χ^2) tests of independence. These analyses focussed on determining if five demographic variables (residency, age, gender, level of education, and income) influenced people's awareness of environmental programs (quarterly marine debris surveys; litter tagging; creek catchment community working bees at Briffney Creek; and a community awareness campaign), their littering behaviours and guilt associated with littering, and perceptions of the main source of beach litter. A one away ANOVA was used to examine patterns within categories where appropriate. Data was also described using univariate statistics.

3. Results

The surveys collected information from 136 people (a response rate of 76%), providing a 95% confidence level of the sampling frame (the Gladstone population). The sample size slightly over-represents the non-resident workers in Gladstone (estimated 7.1% in 2013; Government Statistician 2012), with 11.7% of our sample being non-resident workers. There was a large proportion (47.8%) of 'other' (e.g., tourists) residence types also represented in our sample, which accurately reflects the tourist trade in the region. Table 1 shows the spread of the sample by respondent gender and residency. The majority of respondents that took the survey were female (62.8%), followed by males (36.5%) and then a small proportion that chose not to identify their gender (0.7%), which under-sampled the male population slightly. The majority of respondents had a university degree (62%), followed by high school level achievement (21.2%) and then university postgraduate degree (16.8%). The majority (34%) of respondents earn in the $34,000–$80,000 income category followed by 22% of respondents in the $80,000–$180,000 category.

Respondents considered that beach users (37%) and storm water drains (36%) were the most common source of marine debris. Boat users were considered to be the least likely (21%) activity to create litter. There were no statistically significant demographic influences on a respondent's perception of the main source of marine debris (Table 2).

3.1. Prevalence of littering behaviours and associated guilt

In general, few respondents (9%) admitted to littering. Of those respondents that did admit to littering, their littering behaviours tended to occur at recreational areas (excluding beaches and waterways) (27.8%), followed by beaches (19.4%) and then whilst boating (52.8%). Almost half (48%) of those respondents that admitted to littering stated that they felt strong guilt associated with their littering behaviour. A comparable proportion felt either no guilt (25%), or some guilt (27%). None of the five tested demographic factors (residency, age, gender, level of education attained or income level) statistically influenced a respondent's level of guilt (Table 3).

Age was the only demographic factor that statistically influenced respondent's littering behaviour (Table 4). Respondent's aged 18–36 admit to littering ($\chi^2_{[12]} = 24.883$, $p = 0.015$), whilst

Table 1
Unweighted sample sizes by gender and residency for the Gladstone questionnaire. Non-resident worker includes FIFO, DIDO and workers aiming to spend less than 2 years in Gladstone. 'Other' resident types includes tourists (85.7%) and people that did not identify themselves as permanent or non-resident status.

Gender	Permanent		Non-resident		Other		Total Sample	
	Count	%	Count	%	Count	%	Count	%
Male	16	29	9	56	25	39	50	37
Female	39	71	7	44	40	61	86	63
Total	55	100	16	100	65	100	136	100

Table 2
Demographic influences on a respondents perception of where marine debris originates from. Significance is denoted by a p value <0.05.

Demographic factor	Chi square	Degrees of freedom	p value
Residency	3.503	6	0.744
Age	26.602	18	0.068
Gender	1.698	3	0.637
Level of education attained	4.014	6	0.765
Income	11.963	10	0.288